



United States  
Department of  
Agriculture

Forest  
Service

Southwestern  
Region



# Kaibab National Forest Proposed Land Management Plan

Coconino, Yavapai, and Mojave Counties, Arizona

*(Working Draft)*

May 2011



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# Summary

The Kaibab National Forest (KNF) initiated its Forest Plan revision process by gathering information, talking with partners and holding public meetings. The KNF hosted public meetings in Williams, Tusayan, Flagstaff, Phoenix, Fredonia (all in Arizona) and in Kanab, Utah. There were also focused collaborative meetings on ecological sustainability, Special Areas, restoring fire adapted ecosystems, wildlife, grasslands, springs/wetlands, aspen, and recreation. Consultation and collaboration with American Indian tribes has been ongoing.

This “working draft” of the Kaibab Land Management Plan has been collaboratively developed. This draft is meant to provide a foundation for further collaborative discussion and feedback before the proposed action/preferred alternative is finalized. The intent is to make additions and revisions iteratively until a fully formed proposed plan is developed. The most recent version of the working draft is available on the Kaibab website at:

[http://fs.usda.gov/goto/kaibab/draft\\_plan](http://fs.usda.gov/goto/kaibab/draft_plan)

Detailed assessments, evaluations, reports, and documents associated with the Forest Plan development can be viewed and downloaded from our Kaibab National Forest Land Management Plan Development website:

[http://fs.usda.gov/goto/kaibab/plan\\_rev\\_docs](http://fs.usda.gov/goto/kaibab/plan_rev_docs)

Comments on this draft have been and will continue to be used to refine the proposed land management plan, as well as identify issues and resulting alternatives. We anticipate that the final proposed action will be finalized and scoped with the Draft Environmental Impact Statement (DEIS) in September 2011. The DEIS will evaluate the proposed action and alternatives in detail. Your comments on this proposal may be submitted to:

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Hand-delivered comments can be submitted to the Kaibab National Forest Supervisor’s Office, 8:00-12:00; 12:30-4:30 Monday through Friday, excluding holidays. Electronic comments must be submitted in a format such as an email message, plain text (.txt), rich text format (.rtf), or Word (.doc) to:

[comments-southwestern-kaibab@fs.fed.us](mailto:comments-southwestern-kaibab@fs.fed.us)

Comments received in response to this solicitation, including names and addresses of those who comment, will be considered part of the public record and will be available for public inspection.

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# Chapter 1: Introduction

## Location

The Kaibab National Forest (KNF) is one of six National Forests in Arizona. It covers 1.6 million acres in north-central Arizona, and is located in Coconino, Yavapai and Mohave counties. The KNF is broken into three geographically separate ranger districts: the North Kaibab Ranger District lies to the north of Grand Canyon National Park, the Tusayan Ranger District is to the south of Grand Canyon National Park, and the Williams Ranger District is southern most, separated from the Tusayan Ranger District by private and Arizona State lands (Figure 1). The KNF shares boundaries with Grand Canyon National Park, the Prescott and Coconino National Forests, Bureau of Land Management-AZ Strip District, the Navajo, and Havasupai Indian Reservations, the City of Williams, the town of Tusayan, and private lands.

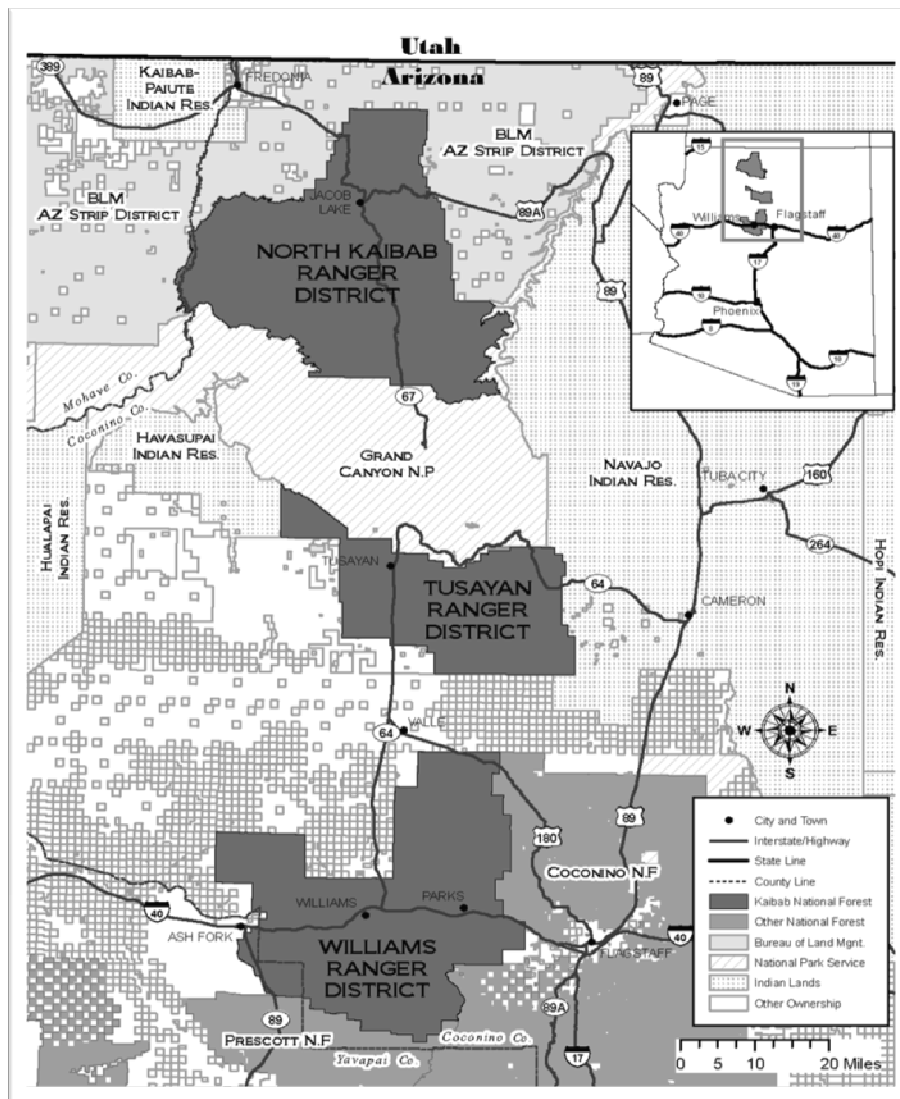


Figure 1. Vicinity map of the Kaibab National Forest.

## Roles and Contributions of the Planning Area

The distinctive history and characteristics of the KNF frames the roles and contributions it serves to the local area, State, region, and Nation. From the high elevation lands of the Kaibab Plateau on the North Kaibab Ranger District to the rolling hills and open country of the Tusayan Ranger District to the scattered cinder cones and canyons on the Williams Ranger District, the KNF includes wide variations in landscape, vegetation, and wildlife. As such, the Forest provides unique resources and recreation opportunities that attract a wide spectrum of Forest users. The diversity of wildlife found on the KNF provides enjoyment and aesthetic value for the photographer, bird watcher, nature lover, hiker, camper, and hunter. The Forest is home to large mammals including mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), bighorn sheep (*Ovis canadensis*), pronghorn antelope (*Antilocapra americana*), mountain lions (*Puma concolor*), black bear (*Ursus americanus*), and many others species.

The KNF has a diversity of vegetation types due to the range of elevation and soil types. Pinyon-juniper woodlands cover 40 percent of the KNF, and are found at lower elevations. As elevation increases, pinyon-juniper transitions to ponderosa pine forest which covers 35 percent of the KNF. Other vegetation types include mixed conifer, grasslands, sagebrush shrublands, Gambel oak shrublands, and desert communities. Aspen, riparian, and wetland vegetation is present in small yet important areas.

Many people have interest in and use the KNF, some of whom have long-time connections to the Forest. American Indian tribes and people in nearby communities have traditional ties to the forest. The KNF contains lands traditionally used by the Navajo, Haulapai, Paiute, Hopi, Havasupai, Yavapai, and Zuni tribes. Uses and activities include forest product collection, hunting, holiday celebrations, and annual events.

Recreationists engage in a variety of activities, such as hiking, camping, sight-seeing, and driving/riding for pleasure. Tourism has played an increased role over the last 20 years. The proximity of the KNF to Grand Canyon National Park attracts visitors from across the nation and throughout the world. Tourism-related activities contribute to local economic development and opportunities. Many area residents have jobs or businesses dependent on Forest resources such as ranching, sandstones quarries, wood harvesting, and outfitter-guiding.

## Plan Purpose and Framework

The Land Management Plan guides the KNF in fulfilling its stewardship responsibilities to best meet the needs of the American people. The Plan provides a framework to support social, economic, and ecological sustainability. This Plan is intended to provide guidance and information for project and activity decision making on the KNF over the “plan period” which is generally considered to be ten to fifteen years. It is strategic in nature and does not specifically authorize any projects or activities. Site specific decisions are made following project specific proposals and analysis, with additional opportunities for public involvement.

As required by the National Forest Management Act and the National Forest System Land Management Planning Rule, all projects and activities authorized by the Forest Service must be consistent with the plan. Projects and activities cover all actions under 16 U.S.C. 1604(i). A project or activity must be consistent with the plan by being consistent with applicable plan decisions.

Where a proposed project or activity would not be consistent with a plan component the responsible official has the following options:

- To modify the proposal so that the project or activity will be consistent;
- To reject the proposal; or
- To amend the plan contemporaneously with the approval of the project or activity so that the project or activity is consistent with the plan as amended. The amendment may be limited to apply only to the project or activity.

The Kaibab National Forest Land Management Plan (hereinafter referred to as Plan) covers the National Forest System (NFS) lands within the KNF boundary, with the exception of the Sycamore Canyon Wilderness, which is covered by the Coconino National Forest Land Management Plan. This Plan provides guidance for all of the Kendrick Mountain Wilderness, including the portion within the boundaries of the Coconino National Forest.

## Summary of the Analysis of the Management Situation

The management situation was analyzed in the 2009 Comprehensive Evaluation Report (CER) and Supplement to the CER (2010). The CER evaluated the need for change in light of how management under the current Plan (as amended) was affecting the conditions and trends related to sustainability. The CER integrated key findings from the Ecological and the Socio-Economic Sustainability Reports. The CER considered information from these two reports and used them to identify where the conditions and trends indicated a need for change the Plan. The Supplement to the CER contains additional analysis and information about projections of demand, benchmarks, and species considerations. Together, these documents meet the content requirements of the Analysis of the Management Situation (AMS). These documents are available for review and are located on the forest's Web site at:

[http://fs.usda.gov/goto/kaibab/plan\\_revision](http://fs.usda.gov/goto/kaibab/plan_revision) or by request.

The CER/AMS and subsequent Management Reviews identified four areas where there were priority needs for change in program direction.

- Modify forest stand structure and density towards reference conditions and restore historic fire regimes.
- Regenerate aspen to insure long-term healthy aspen populations.
- Restore natural waters and wetlands to insure healthy riparian communities.
- Restore historic grasslands by reducing tree encroachment and restoring fire.

New information and changing conditions will call for changes in management. Other needs for change will continue to be identified. As needs are identified, iterative and adaptive planning will facilitate the incorporation of new information. The Plan will be amended as needed over time. Under the National Forest Management Act (NFMA) of 1976, projects and activities must be consistent with the Plan. This proposed Plan and Plan alternatives will focus on the identified needs for change.



## Plan Content

This Plan includes “plan components” and “other content.” Plan Components are displayed in text boxes to distinguish them from other sections of the Plan. Once approved, any substantive changes to plan decisions would require a plan amendment. A change to “other content” may be made using an administrative correction process. Administrative corrections are used to make changes such as updates to data and maps, management approaches, relevant background information and to fix typographical errors. The public is notified of all plan amendments and administrative corrections.

## Plan Components

Plan Components (decisions) include: goals/desired conditions, objectives, standards, guidelines, suitability of uses, special areas, and monitoring. They were developed collaboratively with input from a variety of external and internal stakeholders with broad interdisciplinary representation. The final form and organization of the plan components was refined by an interdisciplinary team make it as understandable, useable, and integrated as possible.

**Goals (Desired Conditions)** describe the aspirational picture for the KNF. They are the ecological and socio-economic attributes toward which management of the land and resources of the plan area are directed. They are not commitments or final decisions approving projects or activities, rather they guide the development of projects and activities. As such, they are to be articulated with enough specificity to be able to determine progress toward their achievement.

**Projects MUST maintain or move toward desired conditions to be consistent with the plan.** In some cases may only be achievable over a long time period. Goals, as required by the 1982 rule provisions, are articulated as “desired conditions” in this Plan.

**Objectives** describe how the KNF intends to move toward the desired conditions. Objectives are concise projections of measurable, time-specific intended outcomes. Objectives are the work that we think needs to be done and the means of measuring progress toward achieving or maintaining desired conditions.

**Guidelines** are technical design criteria or constraints that should be applied when an action is being taken that help to make progress towards desired conditions. A guideline allows for some variations when the result would be equally effective. Deviation from a guideline must be specified in the decision document with the supporting rationale.

**Standards** are technical design constraints that apply when an action is being taken to make progress towards desired conditions. Standards differ from guidelines in that standards do not allow for any deviation without a plan amendment.

**Special Areas** are Lands within the NFS that have designations by Congress or other delegated authority. “Special Areas” are designated because of their unique or special characteristics. Examples include wilderness, research natural areas, botanical areas, and national recreation trails.

**Suitability of Areas** NFS lands are identified as “suitable” for various uses. An area may be identified as suitable or not suitable for certain uses depending on its compatibility with desired conditions and objectives for the area. This plan addresses suitability for timber, grazing, and mineral uses.

**Monitoring** is the part of the adaptive management strategy used to determine the degree to which on-the-ground management is maintaining or making progress toward desired conditions. The monitoring plan includes questions and performance measures designed to inform implementation and effectiveness.

## Other Content

The “other content” in this plan includes background information, existing conditions, management approaches, contextual information, and references to other sources of direction. While the management approaches are not plan decisions, they help clarify how plan direction may be applied. Management Approaches include information and guidance for projects and activity decision making to help achieve desired conditions and objectives.

In addition to plan guidance, this plan references “Other Sources of Direction” found in law, regulation, and policy, as well as direction from prior decisions, species recovery plans, conservation agreements, and Memorandums of Understanding (MOU). The plan does not repeat law regulation, or policy, but does reference them for context and to ensure that projects and activities are consistent with the existing legal framework.

## Plan Concepts

**Adaptive Management** is an approach in which the effects of treatments and decisions are continually monitored and used, along with new scientific information, to modify management on a continuing basis to ensure that objectives are being met. Dynamic issues like climate change, invasive species, and disturbances processes that are not easily predicted call for decision processes to incorporate new and emerging information. Monitoring is essential for learning and continual improvement.

**Sustainability** represents an ecosystem approach management that meets human needs while preserving the environment so that these needs can be met not only in the present, but also for future generations. The principles of sustainability integrate ecological, social and economic elements to be maintained in a healthy state indefinitely.

**Integration** recognizes and identifies key relationships between various plan resources and activities. The plan components are integrated to address a variety of ecological and human needs. For example, desired conditions for ponderosa pine incorporate habitat needs for a variety of species as well as scenic components desired by recreationists. Interrelationships between plan resources and activities are identified with crosswalks to reflect their systematic nature. In electronic versions of the plan, these crosswalks are hyperlinked, which allow users to click on the link (indicated by blue italicized text) and be redirected to other relevant areas of the plan or external references. For example, most of the habitat needs for wildlife are addressed in the vegetation or biogeologic features sections that constitute their habitat.

**Resilience** is an ecosystem concept of much debate. For the purposes of this plan, the term resilience is used to infer the capacity of the system to absorb disturbance and reorganize so it retains essentially the same function, structure, and identity.

**Potential Natural Vegetation** is the vegetation that would occur in the presence of natural disturbance processes such as frequent fire return intervals.

**Natural Variability** references past conditions and processes, which provide important context and guidance relevant to the environments and habitats that native species evolved. Disturbance-driven spatial and temporal variability is vital to ecological systems. Biologically appropriate disturbances provide for heterogeneous conditions and subsequent diversity, whereas “uncharacteristic disturbance” such as high intensity fire can have the effect of reducing diversity, increasing homogeneity and resulting in states that may be permanently altered.

**Climate Change** is addressed indirectly throughout this plan with desired conditions in the form of functional ecosystems and resilient landscapes. Climate change is addressed directly in management approaches and the monitoring plan where appropriate. Appendix 1 provides a more detailed explanation of the strategy the Kaibab National Forest is using to address climate change.

**Management Approaches** describe priorities, and considerations, and strategies for achieving desired conditions. Management Approaches articulate the strategies needed to address effectively making progress towards desired conditions within the context of the operating environment.

**All Lands** is the concept that ecosystems transcend land ownership boundaries, thus effective land and resource management requires cooperation and collaboration among the Forest Service, other land managing agencies, tribes, and private landowners. This plan was developed using an approach whereby development of the plan components were developed considering the greater landscape and the forest’s ecological, social, and economic role.

## Plan Organization

**Chapter 1- Introduction** briefly describes the planning area, the analysis of the management situation, the purpose of this Plan, the plan components, and how they are organized within the plan. This chapter does not contain any Plan decisions.

**Chapter 2 - Forest-Wide Desired Conditions and Strategies** are presented first in this Plan. This chapter includes Desired Conditions (Goals), Objectives, Standards, and Guidelines. This chapter is split into two sections, “Resources” and “Uses, Goods, and Services” (activities). Standards and guidelines are typically located in the relevant activity section of the plan. Where the standards or guidelines pertain to multiple activities, they are sometimes located in the applicable resource section.

**Chapter 3 -Management Areas** contains the plan components applicable to specific areas that call for more site specific management. The management areas chapter is divided into two sections: Special Areas and Land Management Areas (LMAs). Special Areas have specific designations such as wilderness or botanic areas. LMAs include wildland urban interface, utility corridors, developed recreation sites, and other specific places that call for special management such as Red Butte and Bill Williams Mountain.

**Chapter 4 - Suitability** is the appropriateness of applying certain resource management practices to a particular area of land in consideration of the relevant social, economic, and ecological factors. Suitability is determined based on compatibility with desired conditions and objectives in the plan area. Suitability is determined for timber, livestock grazing, mineral activities and grazing. Descriptions of the criteria used in making the determinations are provided along with the results. The identification of an area as suitable for a particular use uses is guidance for

project and activity decision making, and is not a commitment or a final decision approving projects and activities.

**Chapter 5 - Monitoring** and evaluation of plan implementation is used to determine progress toward achieving desired conditions and objectives, and to determine how well management requirements, such as standards and guidelines, are being applied. The monitoring strategy provides a framework for subsequent monitoring and evaluation designed to inform future management.

## Chapter 2: Forest-Wide Desired Conditions and Strategies

This chapter lays out the desired conditions and the strategies the Kaibab National Forest intends to use to achieve them. Desired conditions define what the forest should look like and what goods and services it should provide. Strategies define when, where, and how to achieve the desired conditions. They define the actions needed to move towards desired conditions and the sideboards needed to constrain those actions in the form of objectives, standards, and guidelines.

Desired conditions and strategies related to the major vegetation types are presented first in this plan because they provide the setting/habitat where the other resources occur and activities take place. These desired conditions are integrated and are intended to reflect not only healthy ecological systems, but also the social and economic considerations needed for long-term sustainability.

### Forest Resources

#### *Major Vegetation Community Types*

The Forest contains fifteen major vegetation communities. The major vegetation types are presented in the order of those occupying the greatest acreage of the ecosystem type on the Forest to the least. The identified boundaries for the vegetation communities are based on the potential natural vegetation type that would occur in the presence of natural disturbance processes such as fire.

Desired Conditions are described at multiple scales where appropriate. Descriptions at various scales are sometimes necessary to provide adequate detail and guidance for the design of future projects and activities that will help achieve the desired conditions over time. The three scales used in this plan are: fine scale, mid-scale, and landscape scale.

**Fine scale** is a 10 acre area or less at which the distribution of individual trees (single, grouped, or aggregates of groups) is described. Fine scale desired conditions provide the view.” that could be observed standing in one location on the ground. Fine scale desired conditions contain desirable variation appropriate at smaller spatial scales.

**Mid-scale** desired conditions are composed of assemblages of fine scale units and include descriptions that are desirable when averaged across areas of 100 to 1,000 acre units.

**Landscape scale** is an assemblage of ten or more mid-scale units, typically >10,000 acres, composed of variable elevations, slopes, aspects, soils, plant associations, and disturbance processes. Landscape scale desired conditions provide the “big picture” overview with resolution that could be observed from an airplane, or less frequent components that we would want to be present within the greater landscape.

## **Range of Variables (minimum and maximum values)**

Ranges of values presented in desired conditions account for natural or desired variation in the composition and structure within a community or resource area. Desired conditions may have a wide range due to spatial variability in soils, elevation, or aspect. It may also be desirable to have different desired conditions within a particular vegetation community, such as a lower density of vegetation in the wildland urban interface (WUI) than outside of the WUI to achieve the desired fire behavior within the proximity of property and human occupancy. Higher densities may be desired in other areas, to provide habitat conditions for some species.

## **Vegetation Structure**

Vegetation structure includes both the vertical and horizontal dimensions. Horizontal structure may refer to patterns of trees or groups of trees and openings, as well as tree size and species composition. The vertical component can refer to the layers, appearance, and composition of vegetation between the forest floor and the top of the canopy. Several descriptive terms related to vegetation structure are used in desired condition statements and are defined in the Definitions section found in Appendix 1.

## **Pinyon-Juniper Communities**

The Pinyon-Juniper vegetation communities are collectively composed of the Juniper Grassland, Pinyon-Juniper Grassland, Pinyon-Juniper Sagebrush, and Pinyon-Juniper Persistent Woodland communities. Pinyon-Juniper communities generally occur at elevations between 5,300 and 7,400 feet. They occur on all three districts and cover about 638,000 acres. Pinyon-Juniper communities are the setting for a variety of uses and activities including wood cutting, livestock grazing, camping, hunting, and pinyon nut gathering.

Under their natural disturbance regime, these plant communities are dominated by one or more species of pinyon pine and/or juniper with at least ten percent tree canopy. They can occur with a grass/forb dominated understory (Pinyon-Juniper Grasslands and Juniper Grassland forest communities), a shrub dominated understory (Pinyon-Juniper Sagebrush forest community), or a sparse discontinuous understory of some grasses and/or shrubs (Pinyon-Juniper Persistent Woodland forest community). Two-needle pinyon pine is common; as well as one-seed, Utah, Rocky Mountain, and alligator juniper. Species composition varies by location.

Most of the pinyon-juniper vegetation communities are currently younger and denser than they were historically due to changes in wildfire occurrence. Increased tree density increases competition for water and nutrients. This in turn causes a reduction in understory plant cover and diversity, a loss of ground cover, and subsequent increase in soil erosion.

Pinyon-juniper communities provide important winter and spring range for wildlife. Mature pinyon-juniper stands are particularly important for bird species of conservation concern, many of which rely on the habitat features provided only by mature stands. Such features include large-diameter trunks for nest cavities and greater berry and seed production.

On the North Kaibab RD, pinyon-juniper habitat provides primary and critical winter range and transitional habitat during migration for mule deer. Similarly, pinyon-juniper habitat on the Williams and Tusayan RDs provides winter and transitional range for elk and other game species.

Pinyon-juniper woodlands are an important social setting and provide for uses such as livestock grazing, hunting, fuelwood and pinyon nut gathering.

### ***Desired Conditions Common to Pinyon Juniper Communities***

- Pinyon-juniper woodlands exist as a mosaic across the landscape with a mix of young and mature patches. Canopy cover is at least 10% and the structure and composition reflects the natural range of variation.
- The mature patches are structurally diverse, containing large live trees, as well as trees with dead or broken tops (“green snags”), gnarls, and burls. There are some large standing dead trees (1/acre, 10-inch diameter at root collar) and large downed trees (2/acre of 10-inch diameter and 10 feet long). Some areas have higher canopy closure that provide opportunities for nesting, bedding, and foraging.
- A shifting mosaic of continuous canopy is interspersed with openings across the landscape. There is connectivity of openings between trees that provide for sufficient sighting distance to facilitate pronghorn movement. Large contiguous stands of pinyon-juniper occur as they did historically.
- Large snags and old trees with dead limbs and tops are scattered across the landscape. Large coarse woody debris is present.
- Plant litter (leaves, needles, etc.) and understory plant cover is present in sufficient quantity to stabilize soils, prevent erosion, promotes nutrient cycling, improve water retention, and provide the microclimate conditions necessary for pinyon seed germination.
- “Nurse trees” provide understory microclimate with improved nutrient and soil properties, higher soil moisture, and lower temperatures, and lower light levels. This increases the survival of pinyon seedlings under harsh conditions.
- There are opportunities for collecting forest products (firewood, pinyon nuts, posts and poles etc.) consistent with other desired conditions.
- A robust crop of pinyon pine nuts are regularly produced.

### **Pinyon-Juniper Grasslands**

The Pinyon-Juniper Grassland vegetation type is composed of the Pinyon-Juniper Grassland and Juniper Grassland vegetation communities. These areas historically had at least ten percent tree canopy cover with an understory dominated by grassland species, often on deep soils with gentle topography. Areas that historically had less than 10% canopy cover are classified as grasslands. This distinction is necessary for distinguishing between vegetation types and their respective desired conditions, but it is recognized that transition between pinyon-juniper grasslands and grassland savanna actually occurs along a gradient.

## Pinyon-Juniper Grasslands Desired Conditions

- Pinyon-Juniper Grasslands are generally uneven aged and open in appearance. Trees occur as individuals, but occasionally are in small groups. Scattered shrubs and a dense herbaceous understory including native grasses, forbs and annuals are present to maintain soil productivity, resist soil erosion and can support frequent low intensity surface fires.
- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances (including insects, diseases, and fire) and climate variability. Fires are typically low-severity with a 0 to 35 year return interval (Fire Regime I).
- Understory height provides adequate cover for pronghorn antelope fawning, small mammal foraging, and songbird nesting when seasonal climatic conditions allow.
- Understory composition contains diverse native herbaceous plant species that provide nutrition for pronghorn and other species within the natural range of variability.

## Pinyon-Juniper Sagebrush Communities (Pinyon-Juniper Shrub)

In the Pinyon-Juniper Sagebrush vegetation community, sage is the dominant shrub in most areas. However, in some areas, other shrub species may be dominant and sagebrush may not even be present. These lands may better be described as Pinyon Juniper shrublands, but for consistency with the potential natural vegetation types (PNVTs) identified for the Southwestern Region, they are referred to as Pinyon-Juniper Sagebrush communities.

Pinyon Juniper Sagebrush communities are concentrated in areas dominated by cold season precipitation regimes. They are usually found on sites with coarse-textured, gravelly, or lithic soil characteristics. Pinyon is occasionally absent, but one or more juniper species are always present. These systems have open woodland canopies interspersed with Colorado Plateau and Great Basin shrub species such as big sagebrush (*Artemisia tridentata* Nutt.), rubber rabbitbrush (*Ericameria nauseosa* (Pall. Ex Pursh)), fourwing saltbush (*Atriplex canescens* (Pursh) Nutt.), and winterfat (*Krascheninnikovia lanata* (Pursh)).

Typical disturbances include fire, insects, and disease. Contemporary disturbances include mechanical removal of overstory trees. Fire absence since Euro-American settlement has not resulted in dramatic increases in tree densities as with other woodland types, presumably since fire occurrence may not have been significantly altered in this community type.



## Desired Conditions in Pinyon-Juniper Sagebrush Communities

- The Pinyon-Juniper Sagebrush Shrub forest type is a mix of trees and shrubs, ranging from young to old, that occur as shifting vegetation states (herbaceous-dominated, shrub-dominated, and tree-dominated) in even-aged and uneven-aged patches with a variable understory. There is a mix of large (old) and small to mid size juniper.
- The shrub component consists primarily of sagebrush, but oak, cliffrose, and other shrub species may also be present.
- The understory is dominated by moderate to high density shrubs depending on successional stage. The shrub component consists of one or more shrub species, which are well-distributed. Shrubs typically are in a closed canopy state during the later successional stages.
- The composition, structure, and function of vegetation conditions are resilient to the frequency, extent and severity of disturbances including insects, diseases, fire, and climate variability. Fires are mixed to high severity and have fire return interval of 35 to more than 200 years (Fire Regimes III and IV).

## Pinyon-Juniper (Persistent) Woodlands

Persistent woodlands are scattered and not associated with a particular soil type, but occur where soils are thin and rocky. Historically, they were found on rugged upland sites that were not capable of developing an understory that could carry fire.

## Pinyon-Juniper Woodland Desired Conditions

- The Pinyon-Juniper (persistent) woodlands are highly variable in age, structure and density. Shrubs are sparse to moderate, and herbaceous cover is low and discontinuous due to soil and other site conditions.
- Snags and green snags are present.
- Disturbances rarely affect the composition, structure, and function. Insects, disease and mistletoe occur at endemic levels. Fire disturbance is infrequent and variable due to lack of continuous ground cover.

## ***Guidelines for Management Activities in Pinyon-Juniper Communities***

- The Pinyon-Juniper subtype should be determined prior to developing project proposals to ensure the appropriate desired conditions are applied.
- Restoration efforts should emphasize the retention of mature stands (where they occurred historically) with a mix of mature trees, snags, and partially dead, or dying trees.
- Pinyon-juniper communities should maintain tree densities that maximize herbaceous plant growth and wildlife species diversity.
- Where pinyon-juniper obligate species exist (e.g. gray vireo), project designs should include provisions for retaining key habitat features (e.g. selective pruning, lop and drop, etc).
- Project design for vegetation management activities should prioritize treatment areas along known wildlife corridors and historic openings.
- Restoration treatments in pinyon-juniper should be rotated over time and various successional stages to maximize wildlife habitat and diversity.

## ***Management Approach for Pinyon Juniper Communities (with exception of persistent Pinyon-Juniper Woodlands).***

Although management is needed to achieve and maintain desired conditions in Pinyon Juniper Communities, it was not identified as a priority need for change in the CER/AMS. Due to limited capacity, the Forest is not currently setting restoration objectives for this vegetation type. In order to achieve and maintain desired conditions, the forest may thin or burn to reduce juniper densities to increase growth and vigor of understory species, reduce fuel loads, improve wildlife habitat, reduce vulnerability to pinyon Ips beetles, and increase herbaceous vegetation composition and cover. Strategies to accomplish work include:

- Working collaboratively with tribes, Arizona Game and Fish and other partners to plan and implement projects that will make progress toward desired conditions.
- When possible, allow natural ignitions to be managed for resource benefits and achieve desired conditions.

*[Additional guidance for Pinyon Juniper communities can be found in the forestwide direction for Noxious and Invasive Species, Wildlife, Forestry and Forest Products, and Wildland Fire Management].*

## **Ponderosa Pine Forests**

The ponderosa pine forest vegetation community includes two sub-types: Ponderosa pine-bunchgrass and ponderosa pine-Gambel oak. The ponderosa pine forest vegetation community generally occurs at elevations ranging from 6,200 to 8,200 feet. It occurs on all three districts and covers about 541,000 acres. It is dominated by ponderosa pine and commonly includes other species such as oak, juniper, and pinyon. Species such as aspen, Douglas-fir, white fir, and blue

spruce may also be present, but occur infrequently as individual trees. This forest vegetation community typically occurs with an understory of grasses and forbs although it sometimes includes shrubs.

Ponderosa pine forests are used by a variety of wildlife including numerous birds, small mammals, elk, mule deer, and is particularly important for tassel-eared squirrels. Gambel oak, a component of the ponderosa pine cover type, is particularly important to many wildlife species, including Mexican spotted owls. Higher species richness has been correlated with higher densities of Gambel oak, a habitat that provides critical nesting and foraging resources for many northern Arizona birds.

The open park like stands characteristic of historic ponderosa pine forests promoted greater faunal diversity and fire resilience than the dense stands of today. The ponderosa pine forests are popular places to escape the heat in the summer and are the setting for many recreation activities including camping, hunting, hiking, sightseeing, and wildlife watching.

Ponderosa pine forests on the KNF are generally denser and more continuous across developmental states than in reference conditions and accumulations of forest litter and woody debris are much higher than would have occurred under the historic disturbance regime. Lack of fire disturbance has led to increased tree density and fuels loads that increase the risk of uncharacteristically intense wildfire and drought related mortality. When fires occur under current conditions, they tend to kill a lot of the large and old trees, moving the forest further from desired conditions, thereby increasing the time it would take to return to historic sustainable conditions. There is a moderate risk of insect and/or disease outbreak, which is also a function of increased tree density.

### ***Fine Scale (≤10 acres) Ponderosa Pine Forest Desired Conditions***

- Trees typically occur in irregularly shaped groups and are variably-spaced with some tight clumps. Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Tree groups are made up of clumps of various age classes and sizes classes which occur in areas typically less than 1 acre.
- Crowns of trees within the mid-aged to old groups are interlocking or nearly interlocking and consist of approximately 2 to 40 trees.
- Openings surrounding clumps and groups are variably shaped and comprised of a grass/forb/shrub mix. Some openings contain individual trees.
- Fires generally burn as surface fires, but single tree torching and isolated group torching is not uncommon.
- Where historically occurring, there are oak thickets containing various diameter stems, and low growing, shrubby oak. These thickets provide forage, cover, and habitat for a variety species that depend on them such as small mammals, foliage-nesting birds, deer and elk. Large oaks snags and partial snags with hollow boles or limbs are present.
- Gambel oak mast (acorns) provides food for wildlife species.
- Isolated infestations of dwarf mistletoe may occur, but the degree of severity and amount of mortality varies among the infected trees. Witch's brooms may form on infected trees, providing habitat for wildlife species.

### ***Mid-Scale (100-1000 acres) Ponderosa Pine Forest Desired Conditions***

- The ponderosa pine forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages present.
- Stands are dominated by ponderosa pine but other native species occur.
- The more biologically productive sites contain more trees per group and more groups per area. Basal area within forested areas generally ranges from 20 to 80 feet<sup>2</sup>/acre. Openings with grass/forb/shrub vegetation are variably-shaped and occupy 10% in the more productive types and 70% in less productive sites.
- Forest conditions in some areas contain 10 to 20 % higher basal area in mid-aged to old tree groups than in the general forest (e.g. goshawk post-fledging family areas, Mexican spotted owl protected areas, drainages, and steep north facing slopes).
- Patches of even-aged forest structure are present, but are infrequent. Disturbances sustain the overall variation in age and structural distribution.
- Snags 18 inches DBH or greater average 1 to 2 snags per acre. Snags and green snags of variable size and form are common.
- Downed logs (greater than 12 inches diameter at mid-point, and greater than 8 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris greater than 3 inches in diameter (including downed logs), ranges from 3 to 10 tons per acre.
- Fires primarily burn on the forest floor and typically do not spread between tree groups as crown fire.

## ***Landscape Scale (> 10,000 acres) Ponderosa Pine Forest Desired Conditions***

- The ponderosa pine forest vegetation community is a mosaic of forest conditions composed of structural stages ranging from young to old trees. The forest is generally uneven-aged and open. Groups of old trees are mixed with groups of younger trees. Occasional areas of even-aged structure are present. Denser tree conditions exist in some locations such as north facing slopes, canyons, and drainage bottoms.
- The ponderosa pine forest is composed predominantly of vigorous trees, but declining trees are present. Snags, green snags, and coarse woody debris are well-distributed throughout the landscape.
- Older vegetation stages and associated “old growth” components (declining trees, snags, downed logs, and old trees) are well distributed in the landscape.
- The landscape is a functioning ecosystem that contains all its components, processes, and conditions associated with endemic levels of disturbances (e.g. fire, dwarf mistletoe, insects, diseases, lightning, drought, and wind)
- Forest vegetation conditions are resilient to the frequency, extent, and severity of disturbances and climate variability.
- Grasses and needle cast provide the fine flashy fuels needed to maintain the natural fire regime. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function.
- Fire and other disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris loads, and nutrient cycling. Frequent, low severity fires (Fire Regime I) occur across the entire landscape with a return interval of 0 to 35 years.
- Smoke emissions are relatively low.
- The risk of uncharacteristic high intensity fire and associated loss of key ecosystem components is low.
- Where it naturally occurs, Gambel oak is present with all age classes represented. It is reproducing and maintaining or expanding its presence on suitable sites across the landscape.

## ***Objectives for Ponderosa Pine***

To reduce the potential for active crown fire in ponderosa pine communities:

- Mechanically Thin 11,000 to 19,000 acres annually.
- Burn an average of 13,000 to 55,000 acres annually using a combination of prescribed fire and naturally ignited wildfires.

To restore ponderosa pine in areas with inadequate seed source:

- Plant 300 to 700 acres annually.

### ***Management Approach***

Ponderosa pine forests have been given management emphasis in this plan because they are highly departed from historic conditions and were identified as a priority needs for change. Projects in ponderosa pine are aimed at restoring processes such as low intensity fire, pollination, and nutrient cycling, as well as promoting natural diversity such as oak, aspen, openings, and understory plant species. While treatments strive to mimic historic structure and patterns, they often also address a range of other objectives. As a result, reconstructed historic reference conditions are general guides, rather than rigid restoration prescriptions.

Reintroduction of fire as the primary disturbance agent provides critical restoration process. However, fire management needs to maintain an appropriate balance between smoke emissions and public health.

Closed canopies are a primary indicator for determining high risk of loss due to uncharacteristic wildfire. Areas with closed canopy areas containing large trees are a higher priority for restoration because they have more of components of the desired condition and a single treatment may achieve the desired condition in a relatively short time frame. If lost, those legacy components would take many years to replace.

Dwarf mistletoe is a natural disturbance agent. In some areas, levels of infection are unsustainable and exceed historic (and desired) levels. As a result, treatments for controlling mistletoe are aimed at maintaining infection levels that allow for development of a diversity of age-classes across the landscape, not to eliminate this naturally occurring disturbance agent.

Pine-oak habitat is managed as Restricted Habitat under the Mexican Spotted Owl Recovery Plan (USDI 1995). Many individual large oak trees as well as oak copses have become over-topped with pine trees. Treatments to promote oak regeneration and establishment are fairly effective, because oak sprouts prolifically after release treatments and may be cut or burned to stimulate new growth, maintain growth in large diameter trees, or to stimulate mast production.

Illegal wood cutting is probably the biggest threat to oak, reducing both the amount and quality of oak habitat. Enforcement, education, and site specific planning are needed to ensure quality oak habitat over the long term. Fuelwood sales are managed so that site specific planning and permits may address specific resource concerns.

Thinning and burning activities would first be implemented in the areas identified by the Kaibab Forest Health Focus (KFHF) and then move to other areas of high risk. The KFHF was a multi-stakeholder collaborative process that prioritized areas most in need of treatment (See Appendix 4). Thinning and burning prescriptions need to effectively make progress toward the desired conditions and retain characteristics of desired conditions for at least twenty years. A combination of treatments and tools will be needed to achieve the desired condition. Tools for creating openings include group selection (see glossary) and managed wildland fire.

The Four Forest Restoration Initiative is a large-scale collaboratively driven project with the goal of restoring forest ecosystems on portions of four National Forests – Coconino, Kaibab, Apache-Sitgreaves, and Tonto. This large scale planning effort will help to attain desired conditions over a large portion of the Williams and Tusayan District. Coordination with the 4FRI planning effort has been ongoing to ensure consistency with this plan.

## **Other Sources of Direction**

Recovery Plan for the Mexican Spotted Owl

[http://www.fws.gov/southwest/es/mso/critical\\_habitat/recovery\\_plan.htm](http://www.fws.gov/southwest/es/mso/critical_habitat/recovery_plan.htm)

*[Additional guidance for ponderosa pine management is found in Wildlife, Non-native Invasives, Air Quality, Forestry and Forest Products, Fire Management sections of this plan]*

## **Mixed Conifer Forests**

Mixed Conifer Forests occur on the North Kaibab and Williams Ranger Districts and cover approximately 147,000 acres. The mixed conifer forests on the KNF include three vegetation communities: Frequent fire Mixed Conifer, Wet Mixed Conifer, and Spruce-fir. Frequent fire mixed conifer forests are the most common and are characterized by a frequent, low intensity fire regime. Wet mixed conifer and spruce-fir occur at moister, higher elevation sites, are interspersed with each other and do not occur individually above the mid scale on the KNF. Because of their interspersed and similar desired conditions, they are addressed together in this plan.

### **Mixed Conifer (Frequent Fire)**

The frequent fire mixed conifer forest vegetation community, often referred to as “dry mixed conifer” is transitional vegetation type with increasing elevation between ponderosa pine and wet mixed-conifer forest communities. It generally occurs at elevations ranging from 7,300 to 9,500 feet, but occurs at lower elevations in drainages, particularly on steep north facing slopes. Ponderosa pine is the most common tree species in the frequent fire mixed conifer forest community, which distinguishes it from the wet mixed conifer/spruce fir community. Frequent fire mixed conifer forests are dominated by shade intolerant trees such as ponderosa pine, southwestern white pine, quaking aspen, and Gambel oak. Douglas fir is often present, with lesser amounts of shade tolerant species such as white fir and spruce. This forest community typically occurs with an understory of grasses, forbs, and shrubs.

### **Fine Scale (≤10 acres) Desired Conditions for Frequent Fire Mixed Conifer Forests**

- Trees typically occur in irregularly shaped groups and are variably-spaced with some tight clumps. Crowns of trees within the mid-aged to old groups are interlocking or nearly interlocking. Openings are composed of a grass, forb, and shrub mix. Some openings contain individual trees or snags. Trees within groups are of similar or variable ages and often contain more than one species. Size of tree groups typically are less than 1 acre, and at the mid-aged to old stages consist of 2 to approximately 50 trees per group.
- Dwarf mistletoe infections may be present on ponderosa pine and Douglas-fir, and rarely on other tree species, but the degree of infection severity and amount of mortality varies among infected trees. Witches brooms may be present with these infestations, providing habitat for wildlife.
- Fires generally burn as surface fires, but single tree torching and isolated group torching occasionally occurs.

### ***Mid-Scale (100 to 1000 acres) Desired Conditions for Frequent Fire Mixed Conifer***

- The dry mixed conifer forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. Forest appearance is variable but generally uneven-aged and open; occasional patches of even-aged structure are present.
- Forest conditions in some areas contain 10 to 20 % higher basal area in mid-aged to old tree group than in the general forest e.g. goshawk post-fledging family areas (PFAs), Mexican spotted owl protected habitat, and north facing slopes.
- The more biologically productive sites contain more trees per group and more groups per area. Basal area within forested areas generally ranges from 30 to 100 ft<sup>2</sup>/acre. Openings with grass, forb, and shrub vegetation typically range from 10 to 50 % of the area.
- The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages. Occasionally small patches (generally less than 50 acres) of even-aged forest structure are present. Disturbances sustain the overall variation in age and structural distribution.
- Where they naturally occur, groups or patches of aspen and all structural stages of oak are present.
- Snags and green snags, 18 inches dbh or greater average 3 per acre. Downed logs (greater than 12 inches diameter at mid-point and greater than 8 feet long) average 3 per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 5 to 15 tons per acre.
- Fires burn primarily on the forest floor and typically do not spread between tree groups as crown fire.



### ***Landscape Scale (≥10,000 acres) Desired Conditions for Frequent Fire Mixed Conifer Forests***

- At the landscape scale, the dry mixed conifer forest community is a mosaic of forest conditions composed of structural stages ranging from young to old trees.
- Older natural seral stages and associated “old growth” structure is well distributed across the landscape and occurs as groups of old trees, often mixed with groups of younger trees or occasionally as a patch comprised mostly of old trees. Denser tree conditions exist in some locations such as north facing slopes, canyons, and drainage bottoms.
- Forest appearance is variable but generally uneven-aged and open; occasional patches of even-aged structure are present. The forest arrangement is in small clumps and groups of trees interspersed within variably-sized openings of native grass/forb/shrub vegetation associations similar to historic patterns. Size, shape, number of trees per group, and number of groups per area are variable across the landscape.
- Where they naturally occur, groups of aspen and all structural stages of oak are present.
- The dry mixed conifer forest community is composed predominantly of vigorous trees, but declining trees are present in addition to snags, top killed, lightning and fire scarred trees, and coarse woody debris (greater than 3 inch diameter) are well-distributed throughout the landscape.
- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, severity of disturbances, and to climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (e.g. fire, insects, diseases, and wind), including old growth trees.
- Dwarf-mistletoe is present and infects ponderosa pine and Douglas-fir, but occurs in less than 15% of host trees in uneven-aged forest structures and less than 25 % in even-aged forest structures, although large infestation may occur.
- Grasses and needle cast provide the fine flashy fuels needed to maintain the natural fire regime. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Frequent, low severity fires (Fire Regime I) occur across the entire landscape with a return interval of 0 to 35 years. Fire and other disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

## ***Objectives for Vegetation Management in Frequent Fire Mixed Conifer Forests***

- Burn an average of 1,000 to 13,000 acres annually using prescribed fire and/or naturally ignited wildfires.
- Mechanically thin 18,000 to 32,000 acres over the plan period.

## ***Guidelines for Vegetation Management in Frequent Fire Mixed Conifer Forests***

- Vegetation Management activities in frequent fire mixed conifer forests should incorporate experimental design features and monitoring to accelerate learning and adaptive management.

## ***Management Approach***

The area south and west of North Canyon in the Saddle Mountain Wilderness, was identified as a high priority treatment area by the Kaibab Forest Health Focus. The treatment strategy identified was to treat this area first and then move to other areas of high fire risk. Fire only treatments may be appropriate for areas with open canopies and low fuel loads. Mechanical fuel reduction may be needed in many frequent fire mixed conifer areas before fire can be safely reintroduced. Limited agreement about treatment intensity and practices among stakeholders may call for initial treatments to include provisions for an experimental design approach and multiparty monitoring.

A broad acreage range is provided in the treatment objectives in this vegetation community. Treatment with prescribed burns has shown to be costly, with narrow windows of opportunity. The ability to manage naturally ignited wildfires to achieve resource benefits has been very limited, and much remains to be learned. The amount of acres treated annually is likely to increase over the plan period as new information becomes available about treatment practices and effects, and adaptive management is implemented. Additionally, as fuel loading is reduced on more acres, there will be an increased ability to allow fire to play its natural role.

Mixed conifer forest is managed as Protected Habitat under the Mexican Spotted Owl Recovery Plan (USDI 1995). The KNF works closely with the US Fish and Wildlife Service to address the habitat needs of Mexican spotted owls.

## ***Other Sources of Direction***

Recovery Plan for the Mexican Spotted Owl

[http://www.fws.gov/southwest/es/mso/critical\\_habitat/recovery\\_plan.htm](http://www.fws.gov/southwest/es/mso/critical_habitat/recovery_plan.htm)

*[Additional guidance for frequent fire mixed conifer forests is found in the Wildlife, Invasive Species, Recreation, and Forestry and Forest Products sections of this plan.]*

## **Mesic Mixed Conifer / Spruce-Fir Forests**

The mesic (wet) mixed conifer/spruce-fir forest vegetation community generally occurs at elevations ranging from approximately 6,800 to 9,500 feet. Tree species composition varies depending on seral stage, elevation, and moisture availability. This forest vegetation community

can be composed of early seral species such as aspen, Douglas fir, New Mexico locust, southwestern white pine, or late seral species such as maple, white fir, corkbark fir, and spruce. Forests dominated by Engelmann spruce intermixed with corkbark fir and aspen occur at the highest elevations such as the top of Kendrick Mountain and the highest elevations of the Kaibab Plateau. Ponderosa pine present in minor proportions which distinguishes it from Frequent Fire Mixed Conifer.

Disturbances in this vegetation community typically occur at two spatial and temporal scales: larger infrequent disturbances (mostly fire) and smaller more frequent disturbances (fire, insect, disease, wind). On the KNF, this vegetation community rarely occurs continuously at the landscape scale (> 1000 acres). The mesic mixed conifer / spruce fir vegetation community has an understory of a wide variety of shrubs, grasses, and forbs depending on soil type, aspect, elevation, disturbance, and other factors.

### ***Fine Scale (≤10 acres) Desired Conditions for Mesic Mixed Conifer/Spruce-fir***

- Mid-aged and older trees are typically variably-spaced with crowns interlocking (grouped and clumped trees) or nearly interlocking. Trees within groups can be of similar or variable species and ages.
- Small openings (gaps) are present as a result of disturbances.
- Due to the presence of ladder fuels, fires usually burn either with low intensity, smoldering combustion or they transition rapidly in the canopy as passive or active crown fire.
- Dwarf mistletoe infections may be present on Douglas-fir or spruce and rarely on other tree species, but the degree of infection severity and amount of mortality varies among infected trees. Witch's brooms may be present with these infestations, providing habitat for wildlife.

### ***Mid-Scale (100 –1000 acres) Desired Conditions for Mesic Mixed Conifer/Spruce-fir***

- The size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Patch sizes vary but are frequently hundreds of acres; groups and patches of tens of acres or less are relatively common.
- Forest conditions in some areas contain higher basal area than the general forest e.g. goshawk post family fledgling areas, Mexican spotted owl protected habitat, and north facing slopes.
- There is a mosaic of primarily even-aged groups and patches, which vary in size, species composition, and age.
- Grass, forb, and shrub dominated openings created by disturbance may make up 10 to 100 % of the mid-scale area depending on the disturbance type.
- Aspen is occasionally present in large patches.
- Density ranges from 20 to 250 ft<sup>2</sup>/ac. basal area depending upon disturbance and seral stages of groups and patches.
- Number of snags and downed logs (>12 inch diameter at mid-point, >8 feet long) and coarse woody debris (>3 inch diameter) vary by seral stage. Snags 18 inches or greater at DBH typically range from 1 to 5 snags per acre, with the lower range associated with early seral stages and the upper range associated with late seral stages.
- Coarse woody debris varies by seral stage but ranges average 5 to 20 tons per acre for early seral, 20 to 40 tons per acre in mid seral, and greater than 80 tons per acre in late seral areas.
- Fire severity is mixed or high, with a fire return interval of 35 to over 200 years (Fire Regime III, IV, and V). Fire and other disturbances maintain overall desired tree density, structure, species composition, coarse woody debris, and nutrient cycling.
- During moister conditions, fires exhibit smoldering low intensity surface fires with single tree and isolated group torching. Under drier conditions, fires exhibit passive to active crown fire behavior with conifer tree mortality up to 100 % across mid-scale patches (100-1000 acres). High severity fires generally do not result in areas of mortality exceeding 1000 acres. Other smaller disturbances occur more frequently.

### ***Landscape Scale (≥10,000 acres) Desired Conditions for Mesic Mixed Conifer / Spruce-Fir Forests***

- The wet mixed conifer/spruce-fir forest community type is a mosaic of structural and seral stages ranging from young to through old trees composed of multiple species.
- The landscape level biodiversity is provided by an assemblage of variably-sized and aged groups and patches of trees and other vegetation associations similar to historic patterns. Tree groups and patches are comprised of variable species composition depending on forest seral stages. An approximate balance of seral stages is present across the landscape, each seral stage characterized by distinct dominant species composition and biophysical conditions.
- Older natural seral stages and associated (old growth) structure is well distributed across the landscape and occurs as groups of old trees, often mixed with groups of younger trees or occasionally as a patch comprised mostly of old trees.
- Denser tree conditions exist in some locations such as north facing slopes and canyon bottoms. Canopies in this forest type are generally more closed than in dry mixed conifer. An understory consisting of native grass, forbs, and shrubs is present.
- Predominantly composed of vigorous trees, but with an older declining tree component including snags, top-killed, lightning- and fire-scarred trees, green snags, and coarse woody debris that are well-distributed throughout the landscape.
- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances and climate variability.
- The forest landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (e.g. insects, diseases, wind, snow, and fire), including snags, downed logs, and old trees.
- Dwarf mistletoe infestations may be present in stands that are composed of Douglas-fir or spruce and rarely in other tree species. Infestation size, degree of severity, and amount of mortality would vary amongst the infested stands. Witch's brooms could be scattered throughout the infestations providing structural diversity in the stand and higher quality habitat for wildlife.
- Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function.
- Mixed severity fire (Fire Regime III) is characteristic at the lower elevations of this type. High severity fires (Fire Regime IV & V) is more common at the higher elevations.

### ***Management Approach***

No objectives have been set for this vegetation type. Potential projects in these areas include thinning and burning to restore the historic condition which was much less dense with far fewer shade tolerant trees. The ability to manage naturally ignited wildfires and use prescribed burns to achieve resource benefits has been very limited. As fuel loading is reduced on more areas, there will be an increased ability to allow fire to play its natural role. Limited agreement about treatment intensity and practices among stakeholders may call for initial treatments to include provisions for an experimental design approach and multiparty monitoring.

Mixed conifer forest is managed as Protected Habitat under the Mexican Spotted Owl Recovery Plan (USDI 1995). The KNF works closely with the US Fish and Wildlife Service to address the habitat needs of Mexican spotted owls.

### **Other Sources of Direction**

Recovery Plan for the Mexican Spotted Owl

[http://www.fws.gov/southwest/es/mso/critical\\_habitat/recovery\\_plan.htm](http://www.fws.gov/southwest/es/mso/critical_habitat/recovery_plan.htm)

*[Additional guidance for Mesic Mixed conifer / Spruce-fir management is found in the Wildlife, Wildland Fire management, and Vegetation Management sections of this plan].*

### **Aspen**

Aspen is not considered a distinct vegetation community on the KNF, because aspen typically exists as smaller stands within a larger forest matrix dominated by ponderosa pine or mixed conifer vegetation. As a result, aspen is addressed as a component of other forested communities. Aspen occurs most extensively on the North Kaibab Ranger District at higher elevations, is patchy on the Williams Ranger District, and is known only from three small clones on the Tusayan Ranger District.

At higher elevations, stands can be expansive due to establishment after large scale disturbances like blowdowns or high severity fires. At mid-elevations, aspen can be expansive in wet meadows or on mountain slopes but can also occur in small isolated patches on rock outcrops or steep slopes. At the lower elevations of its range where precipitation is a limiting factor, aspen is generally confined to specific microsite areas, located near springs, meadows, or steep, rocky drainages and side slopes.

Aspen is not usually a climax species on the KNF; rather it is part of the mix of early seral species that are common after disturbances, particularly fire. In the west, dry environmental conditions rarely allow for successful establishment of new aspen seedlings, but major disturbance events can facilitate seedling germination. More typically, aspen reproduces asexually through root suckers that are a clone of the original parent tree. Fire and human disturbances regenerate this shade intolerant species by opening up the canopy and removing conifers from the understory. Without disturbance, conifers gradually overtop aspen, closing the canopy and eventually killing mature trees and reducing regeneration. Aspen is highly susceptible to browsing and disease or death due to bark injuries. Loss of aspen results in a loss of diversity in the forest that could affect avifauna and invertebrates, including pollinators. The loss of aspen can change fire behavior because aspen acts as a natural fire break where it is mixed with coniferous species.

Aspen stands are currently in decline throughout most of the southwest as a result of fire absence, unmanaged forest succession, drought, and over browsing by ungulates. On the Williams District, most stands are generally considered unhealthy. These stands are dying, or are dead because they are overtopped by conifers and are unable to recruit new individuals due to heavy browsing and bark stripping by Rocky Mountain elk.

Aspen stands generally occur on moister sites and tend to have higher biodiversity and a greater abundance of plant, fungi, invertebrate, mammals, and cavity-nesting bird species than the surrounding forest. Aspen is second only to riparian ecosystems in biological diversity on the KNF, and supports more bird species populations than other forested areas in the western U.S.

Even small aspen stands provide refugia. The soft wood of decaying stems and snags provide valuable habitat particularly for cavity-dependent species.

Aspen also has high scenic value. The green leaves and white trunks of aspen provide a natural contrast to the surrounding forest on the KNF. Aspen attract both residents and visitors to northern Arizona to enjoy abundant wildlife, shade, and scenery. During the fall months, the forest is transformed into a patchwork of green and gold, drawing fall color lovers from around the state. Aspen provides unique and seasonal opportunities for hiking, biking, bird watching, nature exploration, picnicking and other recreational activities.

### ***Desired Conditions for Aspen (General)***

- Aspen stands are characterized by disturbances which may include fire, mechanical thinning, insects, pathogens and abiotic factors. Collectively these agents of change promote healthy tree regeneration, decadence, and nutrient cycling. These processes further contribute to high quality wildlife habitat and biodiversity.
- Aspen occurs in natural patterns of abundance and distribution and occurs at current or greater than current levels of abundance.
- Aspen is successfully regenerating and recruiting into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smallest classes.
- Historic fire intervals maintain aspen.
- Understory vegetation consists of abundant shrubby or herbaceous species, providing forage and cover for wildlife and habitat for invertebrates such as pollinators.
- Aspen provide opportunities for scenic enjoyment, recreation, and cultural/spiritual experiences.

### ***Desired Conditions for Aspen within Ponderosa Pine and Frequent Fire Mixed Conifer Forests***

- In ponderosa pine and frequent fire mixed conifer vegetation types, the size, age and spatial extent of aspen stands reflect its historical distribution.
- Coniferous species comprise less than 10% of the overstory.
- Isolated aspen stands provide wildlife refugia and diversity in otherwise conifer dominated landscape.

## ***Desired Conditions for Aspen within Mesic Mixed Conifer / Spruce-Fir Forests***

- Downed aspen and woody debris are scattered across the landscape providing habitat for a variety of wildlife species while contributing to efficient nutrient cycling.
- Aspen occurs as a shifting mosaic across its range with new aspen clones establishing over time.
- The spatial composition of aspen inclusions provides connectivity for various wildlife species when viewed at the landscape scale.
- The size, age, and spatial extent of aspen stands reflect large-scale disturbance patterns and processes.

## ***Objectives Restoring Aspen on the Williams and Tusayan Ranger Districts***

- Fence 200 acres of aspen within 10 years of plan approval.
- Reduce conifer encroachment on 800 acres of aspen within 10 years of plan approval.

## ***Guidelines for Activities in Aspen***

- Aspen trees  $\geq 10$  inches DBH (both live and dead) should be protected during project activities, except where they may pose a risk to aspen fences or regeneration efforts.
- Small patch clear-cuts (less than 5 acres in size) or conifer species removals and wildland fire should be used to stimulate aspen sprouting in areas that have or previously had aspen.
- Aspen restoration efforts should be prioritized by their ecological and genetic contribution to the greater landscape and balanced with the forest's capacity to achieve the desired conditions.
- Elk fencing should be used on the Tusayan and Williams Ranger Districts to protect, enhance, and expand regenerating aspen stands which are considered to be of particularly high ecological and socio-economic conservation value.
- Fences should be regularly inspected and maintained while aspen is recovering. Fences should be removed when no longer needed.

## ***Management Approach***

Collaborate with stakeholders to develop an aspen management protocol which utilizes a systematic approach to recover and sustain aspen and the associated understory native plant communities and wildlife. Work with the Arizona Game and Fish Department (AZGFD) on developing appropriate strategies for managing elk and aspen interactions on the Williams and Tusayan RDs and identifying population goals for elk on the Forest. Other strategies to promote aspen may be employed such as jackstrawing, planting, public education, and improving the forage and browse in the surrounding area to diffuse browse pressure on aspen.



### Sagebrush Shrublands

Sagebrush shrubland communities in northern Arizona represent the southernmost reach of the greater sagebrush biome that covers much of the western United States and parts of southwestern Canada. On the KNF, the Sagebrush Shrubland vegetation community generally occurs at elevations between approximately 4,600 and 7,500 feet. At this southern extreme, the temperature and precipitation regime can limit the extent of grass cover in the sagebrush shrubland of the KNF. The KNF contains a disproportionate amount of sagebrush compared to the greater ecoregions (KNF-CER 2009). These communities are dominated by sagebrush (Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), Basin big sagebrush (*A. t. ssp. tridentata*), Bigelow sagebrush (*A. bigelovii*), black sagebrush (*A. nova*), sand sagebrush (*A. filifolia*), although other shrub species (e.g., rabbitbrush [*Chrysothamnus* spp., *Ericameria* spp.], saltbush [*Atriplex* spp.]), and succulents (e.g., yucca [*Yucca* spp.], cactus [*Opuntia* spp.]) occur and can dominate locally.

The understory, typically sheltered by the shrub overstory, consists of a variety of taller forbs and bunch-grasses, low-growing grasses and forbs, or a well-developed cryptobiotic crust. Plant cover is usually not continuous. Species composition varies by location. Fire disturbance is highly variable in type and frequency across elevation/moisture gradients and site productivity. Historically about two-thirds of this the sagebrush shrublands had mixed severity fire occurring approximately every 120 years, and about one-third of the sagebrush shrublands had stand replacing fire occurring at a longer interval (up to 240 years).

Sagebrush provides variable habitat which can include a mix of shrublands and grasslands. This diversity supports an abundance of birds, animals, and native plants, some specially adapted to the system. Sagebrush shrublands provide critical habitat for migratory bird species, many of which are in decline across the country. Overall wildlife species diversity may be lower in sagebrush systems than in habitat types with greater vertical complexity, but the species that do occur in sagebrush systems often occur nowhere else. Populations of many bird species are dependent on these ecosystems are in decline and many have special conservation status. On the KNF, there are species which depend on shrub steppe habitat including Brewer's Sparrow, Sage Sparrow and Sage Thrasher (AZGF species of greater conservation needs), Green-tailed Towhee, Black-throated Sparrow, and Gray Vireo (USFWS species of management concern) also depend greatly on sagebrush systems and are found on the KNF. The following desired conditions are intended to address these habitat needs.

## ***Desired Conditions for Sagebrush Shrublands***

- The composition, structure, and function of biotic and abiotic components of sagebrush shrublands are within or moving toward the historic range of conditions. The majority of sagebrush is in mid-seral or mature states.
- Enough shrub cover exists to meet the needs of a variety of sagebrush-obligate wildlife species.
- A vigorous, but not necessarily dense, understory community of native grasses and forbs are present.
- Single trees or groups of trees cover less than 10% of any Terrestrial Ecological Survey (TES) map unit polygon and less than 5% of the community. Shrub cover is at least 5% and typically makes up 20% to 50% of any TES soil unit.
- Historically characteristic disturbances play a role in the function of the ecosystem.

## **Guidelines for Vegetation Management in Sagebrush Communities**

- Prior to developing project proposals for restoring Sagebrush communities, a determination should be made of the sagebrush sub-species because they indicate different historic fire regimes.
- Management activities should be designed to mimic the historic disturbance.
- In areas with moderate to high risk of cheatgrass invasion, fire should be excluded if adequate treatments are not available or if they are cost prohibitive.
- Where sagebrush communities are severely degraded, waters should be strategically placed to reduce grazing by elk and cattle.

## **Grassland Communities**

In northern AZ, grasslands can consist of various perennial grasses, wildflowers, yucca, cactus, shrubs and/or trees. Life form composition varies due to fluctuations in the area's diverse topography, elevation and associated microclimates. Grassland communities on the KNF are categorized as Montane/Subalpine, Colorado Plateau/Great Basin, or Semi-Desert. Collectively, these grasslands, savannas, and mountain meadows border every forest type on the Forest. Each bearing its own unique structure, composition, biological components and conservation needs.

Historically, on the KNF, these grassland communities had less than ten percent tree cover and occur between 4,400 and 8,400 feet in elevation. Impacts from grazing, logging, and fire suppression practices that started in the late 1800s are still discernible on the landscape today. These practices reduced or eliminated the vegetation necessary to carry low intensity surface fires across the landscape, thereby altering the natural fire regimes and allowing uncharacteristic forest succession to take place. About 200,000 acres of grassland communities across the Forest have been encroached upon by pinyon, juniper & ponderosa pine trees due to disruption of the historic fire regimes and historic grazing practices. These conditions have been further exacerbated by recent increases in invasive, non-native plants, soil erosion, and "exurban" development (low density rural home development) which further threaten the ecological integrity of grassland systems.

Grasslands provide important habitat for wildlife including birds, mammals and herpetofauna. However functional grasslands are much less abundant than they were historically, which reduces the amount of available habitat for grassland-associated species. Many of these animals including species such as prairie dogs, various snakes, and burrowing owls utilize the consistent environmental conditions found below ground. Grasslands provide valuable breeding sites and foraging opportunities for both resident and migratory birds, a group which has experienced greater declines than any other group of bird species. Pronghorn antelope use grasslands for both cover and forage.

### **Desired Conditions for all Grasslands**

- Vegetation is composed of a mix of native grasses and forbs. The structure, composition, and distribution of vegetation are within the range of natural variability and occur in natural patterns of abundance.
- Historical disturbance processes play a primary role in the function of the ecosystem.
- Vegetation height and cover are sufficient to support the historic fire return interval.
- Grass/forb/shrub canopy cover is typically above 25%, with less than one quarter of any grassland below this range.
- Tree canopy cover ranges from 0% to 9%, depending upon specific site conditions.

### **Objectives for Restoring Grasslands**

- Reduce tree density to less than 10% on 5,000 to 10,000 acres of historic grasslands annually.
- Modify fences and/or install pronghorn crossings on 50 miles of fence within 10 years plan approval.

### **Guidelines for Restoring Grasslands**

- Pronghorn fence crossings should be installed along known movement corridors.
- Prior to implementation of grassland restoration treatments, consideration should be given to making the residual fuelwood available for personal collection.

### ***Management Approach***

Restoration of grasslands was identified as a primary needs for change due to the relatively recent (loss of grassland habitat due to tree encroachment. Strategies for implementing grassland restoration treatments include:

- Delineation of historic grasslands based on TES soil type (mollisols), evidence of presettlement trees, and historic maps.
- Prioritize areas for treatment that are at greater risk off loss and that have the capacity to restore to fully functional, high quality grasslands.

- Public education efforts will likely be needed for the public to understand how conditions have changed to gain public support and
- In areas where native herbaceous cover is sparse and seed sources do not exist, seeding should be considered.

### **Montane / Subalpine Grasslands**

On the KNF, these grasslands occur at elevations from 6,000 to 8,400 feet. This community covers approximately 41,000 acres across the Forest and can be found on all three ranger districts. It is of limited extent though on the Tusayan RD. Areas of montane grasslands vary from small patches (<10 acres) surrounded by conifer forest or large landscape size areas (Demotte Park, Garland Prairie, Government Prairie, and Pleasant Valley are several 1000 acres each). Smaller patches can be circular in shape and coincide with small sinkhole features or long and narrow and coincide with valley bottoms. The montane/subalpine grasslands on the North Kaibab Ranger District are linear and as a result are at a higher risk of loss because trees encroach from the edges and the openings close quickly. They are often forb dominated and are better described as meadows rather than grasslands.

### **Desired Conditions for Montane / Subalpine Grasslands**

- Montane and subalpine meadow vegetation has high soil productivity and biological diversity. Native species occur in natural patterns of abundance, composition, and distribution. Vegetation is healthy and at least stable.
- Vegetation and litter is sufficient to maintain and improve water infiltration, nutrient cycling, and soil productivity.
- Soils can readily absorb, store, and transmit water both vertically and horizontally, accept, hold and release nutrients, and resist erosion. The rate of water infiltration is maintained or increased, which minimizes surface runoff, reduces on-site sheet rill and gully erosion, and subsequent sedimentation into connecting waters downstream.

### ***Management Approach***

Increase and improve vegetative species density, composition and diversity in the surrounding landscapes to improve elk and livestock distribution throughout the landscape.

Provide media and public information focused on the importance of meadows and appropriate activities within wet meadows.

High elevation meadows are unique sites often containing habitat for relict plant species that require cool moist conditions. As a result these areas are of particularly vulnerable to changes in climate.

### ***Colorado Plateau / Great Basin Grasslands***

This community consists of approximately 44,000 acres and is found at between 4,900 and 7,200 feet in elevation on the Tusayan and Williams Districts. It consists of mostly grasses and

interspersed shrubs, typically located in drainage bottoms surrounded by sagebrush or pinyon-juniper habitat. In some cases ponderosa pine forest will be present on the grassland border if it is on a north facing aspect.

Grass species may include but are not limited to: Indian ricegrass (*Achnatherum hymenoides*), threeawn spp. (*Aristida spp.*), blue grama (*Bouteloua gracilis*), fescue spp. (*Festuca spp.*), needle and thread grass (*Hesperostipa comata*), spike fescue (*Leucopoa kingii*), *Muhlenbergia spp.*, James' galleta (*Pleuraphis jamesii*), and Sandberg bluegrass (*Poa secunda*). Shrub species may include but are not limited to: sagebrush (*Artemisia tridentata* spp.), cliffrose (*Purshia stansburiana*), rabbitbrush (*Chrysothamnus spp.*), saltbush (*Atriplex spp.*), Ephedra, snakeweed (*Gutierrezia*), winterfat (*Krascheninnikovia lanata*), and wax currant (*Ribes cereum*). This vegetation type may have had over ten percent shrub cover historically, but less than ten percent tree cover. The area provides valuable winter habitat for deer, elk, antelope, and turkey.

### **Desired Conditions for Colorado Plateau/ Great Basin Grasslands**

- Vegetation height and canopy cover are sufficient to support fire on a 10 to 30 year return interval.

### **Management Approach**

Vegetation management activities may be needed to enhance shrub diversity, distribution, and productivity to support wildlife.

### **Semi-Desert Grasslands**

Semi desert grasslands are found between 4,400 and 6,400 feet in elevation on the North Kaibab Ranger District and covers about 25,000 acres. Species composition consists of mostly grasses and interspersed shrubs. On the KNF, dominant grassland associations/types are blue grama (*Bouteloua gracilis*) grassland, Indian ricegrass (*Achnatherum hymenoides*), threeawn spp. (*Aristida spp.*), fescue spp. (*Festuca spp.*), needle and thread grass (*Hesperostipa comata*), spike fescue (*Leucopoa kingii*), *Muhlenbergia spp.*, James' galleta (*Pleuraphis jamesii*), and Sandberg bluegrass (*Poa secunda*). Shrub species may include but are not limited to: sagebrush (*Artemisia tridentata* spp.), rabbitbrush (*Chrysothamnus spp.*), saltbush (*Atriplex spp.*), Ephedra, snakeweed (*Gutierrezia*), winterfat (*Krascheninnikovia lanata*), and wax currant (*Ribes cereum*). Historically, this vegetation type may have had over ten percent shrub cover, but less than ten percent tree cover. Semi-desert Grasslands provides important winter range for mule deer, and year-long habitat to antelope and bison.

### **Desired Conditions for Semi-Desert Grasslands**

- Vegetation height and canopy cover are sufficient to support fire on a 10 to 30 year return interval.

### **Desert Communities**

The Desert Communities vegetation type occupies a proportionately small area of the KNF, but provides habitat for a number of species not found in other areas. It is only found in the Kanab

Creek Wilderness. It surrounds the Cottonwood-Willow Forest community and occurs at elevations ranging from 3,000 to 4,300 feet. There is sparse to dense vegetation cover that includes desert grasses, desert shrubs, succulent species, and some herbaceous cover. Fire did not historically play a role in this vegetation community.

### Desired Conditions for Desert Communities

- Desert communities are characterized by extensive grasses with a shrub cover less than 30%. Ground cover ranges from 5% to 40%. Shrubs contribute to the native plant diversity and structure. Plant litter occupies up to 5% of the soil surface.
- Density of juniper and other shrubby species is maintained at levels which promote natural fire regimes and long fire return intervals. Fire occurrence is low and infrequent. Natural disturbance regimes include soil engineers such as arthropods and sometimes small mammals.
- Rocky outcroppings and shrubby plant species provide abundant browse and foraging opportunities for mule deer and bighorn sheep.
- Native ungulates are free from disease. Domestic livestock are absent.
- Native plants provide for traditional foods and materials including ephedra, yucca, and prickly pear.

### Guidelines for Desert Communities

- Fire should not be used as a vegetation management tool in Desert Communities.

### Management Approach

Work collaboratively with Arizona Game and Fish and Bureau of Land Management to implement strategies identified in the *Arizona Strip Desert Bighorn Sheep Management Plan* within the Desert Communities of Kanab Creek.

### Gambel Oak Shrublands

On the KNF, the Gambel oak shrubland vegetation community occurs at elevations ranging from 7,000 to 8,600 feet and is associated with relatively steep, rocky, south-facing slopes. Gambel oak shrublands on the southern flank of Bill Williams Mountain on the Williams District and along the East Rim break in Saddle Mountain Wilderness on the North Kaibab Ranger District. Gambel oak shrublands make up less than 0.3 % of the Forest and total approximately 5,360 acres.

## Desired Conditions for Gambel Oak Shrublands

- The system is dominated by native hardwood trees and tall shrubs. Some areas contain many trees with relatively large hollow boles or limbs. Coniferous trees are widely scattered and are frequently mature or old. Young Gambel oak thickets and sometimes other species comprise a patchy shrub layer. An understory of grass and forbs is present.
- Low intensity fire occurs regularly with intervals of < 25 years.
- Non-native species are absent or comprise less than 1% of the total cover.
- Old stands contain habitat for birds and arboreal nesting/roosting mammals. A variety of oak growth forms, sizes, and densities that benefit wildlife species can be found across the landscape.

## Management Approach

Gambel oak may be managed to increase hard mast production, cavities, and deciduous foliage volume to promote and enhance wildlife habitat. Potential activities include thinning encroaching conifers and low intensity fire to kill stems less than 6 inches in diameter (DBH).

## Wetland / Cienega

The Wetland / Cienega vegetation communities are associated with perennial springs or headwater streams where groundwater intersects the surface and creates pools of standing water, sometimes with channels flowing between pools. Soils are often saline. Riparian vegetation occurs in wet areas and ranges widely depending on amount, timing, and water source, as well as biophysical characteristics. Distribution and types of vegetation vary due to gradients in saturated soils and salinity. Some vegetation types found in wetland/cienegas include salt grass (*Distichlis spicata*), yerba mansa (*Anemopsis californica*), and sacaton in more saline areas; in saturated soils rushes, sedges, flat sedges and spike rushes and pools support aquatic vegetation. Wetland /Cienegas have historic and contemporary significance to area tribes.

On the Kaibab, wetland / cienegas primarily occur as ephemeral wetlands at elevations ranging from 5,900 to 9,500 feet, but it also includes high elevation (3,500 to 11,000 ft.) meadows with subsurface flows dominated by herbaceous cover. Historically, this vegetation community would have had less than ten percent tree canopy cover.

Ephemeral wetlands have standing water in them for a portion of the year (typically from snowmelt in years when precipitation is normal to above normal) and are dry for a portion of the year. They provide important resting habitat during spring migration. They cover about 1,500 acres on the North Kaibab and Williams Ranger Districts and include landmarks such as Davenport, Dry, and Duck Lakes on the Williams Ranger District.

Standing water and vegetation in wetlands can range from barely existent in dry periods to highly productive wetlands during wet periods. Tree encroachment and high tree density of adjacent vegetation types lower the water table and reduce water flow in this system.

Drought and flooding are the primary natural disturbances. Fire is an infrequent disturbance, entering from adjacent vegetation types.

### Desired Conditions for Wetland /Cienegas

- Wetlands provide habitat consistent with their flood regime and flood potential.
- Plant and animal species that require wetland habitats have healthy populations within the natural constraints of the particular wetland community.
- Wetlands infiltrate water, recycle nutrients, resist erosion, and function properly.

### Objectives for Wetland /Cienegas

- Restore native vegetation and natural water flow patterns on at least 6 acres of wetlands within 5 years of plan approval.

[See also *Natural Waters*]

### Cottonwood-Willow Riparian Forest

Southwestern riparian ecosystems, which include ephemeral, intermittent, and perennial streams and rivers, are ecologically dynamic habitats characterized by linear patches of vegetation. Riparian systems have decreased in size over the past 100 years, largely a result of human development. In the west, factors such as livestock grazing, beaver extirpation, and road development are commonly attributed to the loss of riparian habitat. Riparian areas are considered one of the most important habitat types for Arizona and the Southwest. Activities such as channelization and river diversion, domestic livestock grazing, timber, invasive species, recreation and infrastructure development have led to a 90% reduction of this habitat type in Arizona and New Mexico compared to historic (presettlement) conditions.

Cottonwood-willow is characterized by dense groves of low, shrub-like trees or tall shrubs to woodlands of small to medium and large-sized trees. This vegetation type is found adjacent to permanent surface water, such as streams and springs. Usually an abrupt transition occurs between this and adjacent shorter and more open desert vegetation communities.

Riparian vegetation height depends on constituent plant species. Willow thickets range from three to ten feet (1 to 3 m) in height while Fremont cottonwoods may exceed 80 ft (24 m). Plant species vary and may exist as a variety of structural stages ranging from seedlings through tree/shrub to large tree. Vegetation within this community is predominantly composed of deciduous species. Common native trees and shrubs, depending on location and elevation, include narrowleaf cottonwood (*Populus angustifolia*), box-elder (*Acer negundo*), bigtooth maple (*Acer grandidentatum*), Rocky Mountain maple (*Acer glabrum*), water birch (*Betula occidentalis*), aspen (*Populus tremuloides*), thin-leaf alder (*Alnus tenuifolia*), New Mexico locust (*Robinia neomexicana*), Scouler willow (*Salix scouleriana*), and arroyo willows (*Salix lasiolepis*). Canopy development and plant density depends on available water, plant species, and site characteristics. Soils vary from silty alluvial to rocky, sandy, well-drained substrates. Hot, dry summers and cool to cold, moist winters characterize this vegetation type.



On the KNF, this vegetation community is located only within the Kanab Creek Wilderness area at elevations ranging from 3,200 to 4,500 feet. Historically, annual flooding was a major disturbance. This community is departed from historic conditions due to upstream diversions, impoundments and tamarisk invasion. As a result, this vegetation type may not occur in large enough patches to be considered a “forest”

### ***Desired Conditions Cottonwood-Willow Riparian Forest***

- The extent, diversity and condition of riparian habitat contribute towards ecological sustainability. Dense shrubbery and high levels of vegetative diversity (structural and compositional) and permanent water provide food, cover, and water for wildlife diversity, including terrestrial and aquatic invertebrates and vertebrates.
- Habitat is characterized by willow and other herbaceous understory species. Snag and gallery tree components comprised 55% mid-aged to mature cottonwood and willow trees, 25% younger trees and 20% in grass, shrubs, suckers, seedlings, and tree sprouts.
- Vegetation is structurally diverse and provides habitat for high bird species diversity and abundance with nesting and foraging opportunities for neotropical migrants.
- Mature cottonwood and other trees provide cavities for cavity-dependent wildlife such as woodpeckers, sapsuckers and secondary cavity users. Tall trees provide lookouts and opportunities for nesting raptors.
- Water flow regime approximates historic conditions (i.e. perennial flows) and flows freely, sedimentation is minimized. Springtime flooding contributes to ecosystem sustainability by optimizing germination conditions for seedlings and/or suckering opportunities from the parent plant.
- When non-native vegetation is present, the spatial and structural composition contributes to overall faunal diversity.
- Grazing from domestic ungulates is minimal or absent.
- Fire is limited or absent in this system.
- Soil is free from compaction and includes sand and gravelly reaches and provides appropriate germination sites for desirable plant species.
- Sandy and vegetated terraces provide habitat for reptiles and amphibians.
- Shallow exposed watersides provide drinking and foraging opportunities for wildlife.

### ***Management Approach***

The Forest recognizes the importance of riparian areas during project planning and implementation and emphasizes their protection while managing them within multiple use guidelines.

Program Managers work with public affairs to communicate the ecological significance of these systems to the broader public, to garner support for restoration activities which will facilitate increased water back into the system. Restoration activities may also include mechanical removal of noxious species (tamarisk, Russian olive) followed by herbicide treatments (if necessary) and active revegetation of desirable species. The recent arrival of tamarisk beetles on the forest

(originally introduced off-forest as a biological control agent) may call for active planting of native species following tamarisk mortality to make progress towards desired conditions.

### ***Other Sources of Direction***

Riparian systems are currently protected by the Federal government through two executive orders. Order No. 11988 (Floodplain Management) requires agencies to minimize adverse impacts to floodplains, while Order No. 11990 (Protection of Wetlands) mitigates impacts to, and enhances the natural resource value of such systems. Furthermore, the USFS is specifically directed under the National Forest Management Act (NFMA) of 1976 to manage riparian vegetation and minimize negative impacts to such areas (36 CFR Part 219). In 2006, a new federal bill was signed to facilitate riparian restoration in the Southwest due to the extreme value of riparian ecosystems and their high risk for exotic species invasion (Salt Cedar and Russian Olive Control Demonstration Act: United States Public Law 109-320 2006).

### **Natural Waters**

Streams, springs, groundwater, and other natural waters are centers of high biological diversity in arid landscapes and the ecological health of those resources is important for forest ecosystem sustainability. Wildlife is more concentrated around open water sources than in the general landscape, and obligate aquatic and semi-aquatic species on the Forest are sometimes entirely dependent on these limited and scattered water sources. Collectively these resources contribute to connectivity for wildlife across the landscape. Springs are highly productive habitats in otherwise low-productivity arid landscapes. Springs are frequently more stable ecologically than surrounding upland ecosystems in arid regions, and may offer biological refugia for some species, particularly narrowly endemic species.

Natural waters provide water and food resources that are especially vital to wildlife; particularly birds, bats, and invertebrates. Springs have important traditional cultural significance to humans inhabiting arid landscapes. Contemporary uses include potable local and urban water supplies and agricultural uses such as livestock watering. These uses are vital to domestic and commercial interests in and around the Forest. In addition, springs provide cultural and recreational opportunities.

### ***Desired Conditions for Natural Waters***

- Stream channel stability and aquatic habitats retain their inherent resilience to natural and other disturbances. Stream channel morphology reflects changes in the hydrological balance, runoff and sediment supply appropriate to the landscape setting.
- Springs and ponds have the necessary soil, water, and vegetation attributes to be healthy and functioning. Water flow patterns, groundwater recharge rates, and geochemistry are similar to historic levels.
- Within its capability, stream flow and water quality is adequate to maintain aquatic habitat and water sources for native and selected non-native wildlife.
- The necessary physical and biological components provide habitat for a diverse community of plant and wildlife species including cover, forage, water, microclimate, and nesting/breeding habitat. Riparian-dependent plant and animal species are self sustaining and occur in natural patterns of abundance and distribution. Native macroinvertebrates are appropriately abundant and diverse.
- Unwanted non-native species do not exert a detectable impact on aquatic and wetland ecosystems.
- Native amphibians are free from or minimally impacted by non-native predation and diseases.
- Springs, streams and ponds have appropriate plant cover to protect banks and shorelines from excessive erosion. Hydrophytes and emergent vegetation exist in patterns of natural abundance in wetlands and springs in levels that reflect climatic conditions. Floating plants such as water lilies and overhanging vegetation exist where they naturally occur.
- Where springs or other natural waters have been modified for livestock and/or human consumption, developments are operational.
- The location and status of springs and water resources is known, organized, and available.

### ***Objectives for Natural Waters***

- Protect and/or restore at least 10 individual springs within 5 years of plan approval.

## ***Guidelines for Activities In and Around Natural Waters***

- Access to natural waters should be restricted to designated trails and points of entry to mediate erosion prevent trampling and inadvertent introduction of non-native and undesirable biota and disease.
- Activities in and around waters should follow the AZGFD protocol for preventing the spread of chytrid fungus (See Appendix XX).
- Fences constructed around natural waters should allow bats and other desirable wildlife to pass through unharmed.
- Diversions of water sources that recharge wetlands should be assessed, mitigated, and eliminated where possible.
- Spring source areas should be preferentially protected.
- Forest springs information should be maintained in a database that facilitates long-term archiving, easy data entry, and comparison with monitoring results.

## ***Management Approach***

Due to the limited information available, Forest efforts and emphasis is placed on improving knowledge on the distribution of water resources and aquatic or wetland biota, resource protection, and rehabilitation of springs, including groundwater flow and geochemical analyses. Potential management activities include fencing or other physical protections, restoration of diversions, and revegetation with native species. Wetlands are diverse and seasonal variations in precipitation greatly affect conditions.

Spring monitoring uses standardized monitoring protocols (i.e., the NFS Level I and II springs monitoring protocols) to facilitate data exchange/pooling of data across the southwestern Ecoregion, particularly for springs with populations of rare or endemic species.

Develop collaborative strategies and partnerships for spring inventory, assessment, restoration, monitoring, and research when appropriate. Utilize volunteers to maintain and improve fence enclosures and decrease agency maintenance costs.

Work with partners and stakeholders (i.e. MNA, GCWC, TNC, GCT, NPS, AGFD, USFWS) to develop a GIS layer of Northern AZ springs/seeps. Collaborate with stakeholders and use public education and outreach to garner support for spring restoration.

Evaluate and minimize the impacts of normal NFS management activities on springs, streams, and wetlands. Reduce or eliminate the impacts of non-native species in aquatic, wetland, and riparian habitats, where practicable.

Secure water rights for springs where there are no existing water rights or claims.

*[See also Wetland/Cienegas vegetation]*

## **Constructed Waters**

Various water impoundments have been constructed for a variety of purposes including reservoirs, constructed lakes, and stock tanks on the KNF. Some of these constructed waters also provide unique riparian habitat for various wildlife species.

### ***Desired Conditions for Constructed Waters***

- Constructed waters provide safe access and egress for wildlife
- Constructed waters do not contribute to the spread of diseases, unwanted non-native species, or unnatural patterns of wildlife distribution.
- Reservoirs maintain high water quality within the seasonal range of variable conditions including temperature, dissolved oxygen, and water levels.
- Artificial water developments in and around aspen stands are limited or non-existent.
- Desirable non-native fish species provide recreational fishing opportunities in reservoirs and constructed lakes consistent with the recovery of native species.

### ***Guidelines for Activities in or Near Constructed Waters***

- In riparian aquatic areas, the AZGFD protocol for preventing the spread of chytrid fungus should be followed (See Appendix 5)
- Drinkers should not be installed in areas where sensitive vegetation or soils would be damaged by browsing or trampling such as riparian areas, aspen stands, and wet meadows.
- Drinkers should be maintained in order to provide water during times of scarcity.
- Scholz Lake should not be managed for recreational sport fishing.

## ***Management Approach***

Work with AZ Game and Fish, grazing permittees, and sporting groups to manage constructed waters. Improve understanding of whether and how drinkers, tanks, and other constructed water features influences wildlife distribution and movement.

## ***Other Sources of Direction***

The Memorandum of Understanding between Forest Service, Southwestern Region, and the State of Arizona Department of Environmental Quality outlines responsibilities and activities related to water quality.

## Wildlife

Differences in past management history, topographical and geological conditions, particularly between the South Zone (Williams and Tusayan) Rangers Districts and the North Kaibab Ranger District provide for variation in wildlife distribution and habitat use. The spatially disjunct nature of the three districts influences movement patterns of wide ranging mammal herds such as elk, mule deer and pronghorn.

While the Forest Service has the ultimate responsibility over Forest System lands, the Kaibab National Forest generally manages the wildlife habitat on National Forest lands, the AGFD is the agency responsible for managing wildlife populations in Arizona, and the US Fish, and Wildlife Service (USFWS) regulates threatened and endangered species.

This plan contains limited species specific direction because most species habitat needs are addressed through management direction of vegetation and biogeologic conditions. The primary needs for threatened, endangered, and sensitive species are addressed through law, regulation, and policy (e.g., recovery plans, conservation agreements).

### ***Wildlife Desired Conditions***

- Wildlife and fish are distributed throughout their potential natural range.
- Habitat is available at the appropriate spatial, temporal, compositional, and structural levels such that it provides adequate opportunity for breeding, feeding, nesting, and carrying out other critical life cycle needs for a variety of vertebrate and invertebrate species.
- Species with specific habitat needs such as snags, logs, large trees, interlocking canopy, and cavities are provided for.
- Grasses, forbs, and shrubs provide adequate forage, cover, fawning, and nesting sites.
- Interconnected habitats allow for movement of wide-ranging species and promote natural predator-prey relationships, particularly for “strongly interactive species” (e.g. mountain lions, prairie dogs).
- Habitat configuration and availability allows wildlife populations to adjust their movements (e.g. seasonal migration, foraging etc.) in response to climate change and promote genetic flow between wildlife populations.
- Human-wildlife conflicts are minimal.
- Goshawk nest areas are multi-aged forests dominated by large trees with relatively dense canopies and interlocking crowns.
- Hunting and other wildlife-based recreation opportunities exist, but do not compromise species populations or habitat.

## **Wildlife Guidelines**

- Project activities and special uses should be designed and implemented to maintain refugia, and critical life cycles needs of wildlife, particularly raptors, Region 3 Sensitive Species, and narrow endemics.
- A minimum of 3 nest areas and 3 replacement nest areas should be designated per goshawk territory. Goshawk nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (NW to NE) aspects. Nest areas should generally be 25 to 30 acres in size.
- Goshawk territories (Post-fledging Family Areas) of approximately 420 acres in size should be designated surrounding the nest areas.
- Human presence should be minimized in occupied goshawk nest areas during the goshawk nesting season, March 1 through September 30.
- Potentially disturbing project related activities should be restricted within 300 yards of active raptor nest sites between April 1 and August 15.

## **Management Approach**

The Kaibab National Forest strives to create and maintain natural communities and habitats in the amounts, arrangements, and conditions capable of supporting viable populations of existing native and desired non-native plants, aquatic, and wildlife species within the planning area, while contributing to broader landscape scale initiatives where appropriate. This is accomplished in an integrative fashion by working closely with range, fire, timber and other resource areas to coordinate and maximize activities for wildlife benefit.

The forest also maintains strong partnerships between the state, other federal agencies, academia, and non-government organizations to accomplish this task. An emphasis is placed on the protection of key habitats that contain threatened, endangered, and/or sensitive species of plants and animals and the. The Forest works with the U.S. Fish and Wildlife Service toward recovery and de-listing of such species and improvement of critical habitats.

The Forest continues to support the Arizona Game and Fish in various capacities directed toward the management of wildlife and wildlife habitat. Areas for potential collaboration include (but are not limited to) achieving management goals and objectives specified in Arizona's State Wildlife Action Plan (SWAP), carrying out the cooperative agreement for the management of the Grand Canyon National Game Preserve, working closely with the Bureau of Land Management, Grand Canyon National Park, and Arizona Game and Fish in managing Desert Bighorn Sheep, and working collaboratively with the Arizona Wildlife Linkages Workgroup to implement strategies identified in the Arizona Wildlife Linkages Assessment as well as the Coconino County Wildlife Corridor Assessment.

The Forest cooperates with state, federal, and non-government organizations to re-establish naturally occurring species which have been affected by anthropogenic activities. This includes species such as the California condor, Northern leopard frog, the Apache Trout, and where feasible and appropriate, the recovery, and/or restoration of strongly interactive species (e.g., wolves, Gunnison's Prairie Dog, etc.) within their historic range.

Cooperation with state and federal wildlife management agencies should also help to minimize conflicting wildlife resource issues related to hunted, fished, and trapped species.

Potential climate change, drought, El Niño southern oscillations (ENSO) and the resulting potential effects of management activities are considered during project planning. Particular species that are sensitive to changes in weather may need special consideration. Changes in typical weather patterns can affect migration habitat use, breeding season, and fecundity (i.e. in hotter drier years, mitigations may be needed to reduce physiological stress on breeding wildlife). Climate change is also considered when designating recovery areas for wildlife species.

A key issue related to successfully effecting ecological change with land management planning is the concept of species and habitat monitoring. The primary purpose of monitoring species and their habitats is to determine whether management actions need to be modified. That is, the results of thoughtful monitoring efforts are important for adapting management activities to new conditions in the planning area. To insure adaptive management goals are achieved, monitoring results from select management and ecological indicators are used to assess management strategies for the improvement of habitat quality, protection of key habitats and to help in the design of conservation strategies.

Ecological indicators and management indicator species (MIS) are selected based on their ability to detect change and sensitivity to stressors. As such, indicator species should have a narrow tolerance for change as a result of anthropogenic disturbance and/or management actions and this response should be detectable against a background of natural environmental variation. Additional criteria include their ability to be effectively and systematically monitored in a repeatable fashion using existing survey methodology and within budgetary constraints. This sets the stage for realistic and useful data acquisition. While ecological indicators largely form the backbone of the monitoring plan, management indicator species are chosen specifically to assess differences among planning alternatives.

The current planning rule requires that species *shall* be selected as MIS to estimate the effects of the planning alternatives on wildlife populations. MIS are selected because their population changes are believed to indicate the effects of management. They are used to evaluate alternatives by displaying the effects of the alternatives in terms of amount and quality of habitat and corresponding population trends. The forest plan and alternatives are required to establish objectives that maintain and improve amount and quality of habitat and animal population trends of MIS.

MIS are selected for those areas most likely to be affected by management. Additionally they should have high site fidelity to particular vegetation types/structure, demonstrate a strong and/or predictable response to management activities against a background of environmental variability, and have population data which is readily available or easy to obtain. Based on these criteria, the Kaibab has identified four MIS: Grace's Warbler, Western Bluebird, Ruby-crowned Kinglet, and Pronghorn. A brief summary of the MIS and what they are an indicator for is in the table below. Detailed information about the selection process and rationale can be found in the MIS selection report, "Management Indicator Species Selection for the Kaibab National Forest Plan Revision" (Stein-Foster and Keckler 2011).



**Table 1. Species proposed for new MIS for Plan Revision.**

Species	Habitat Association	Priority Need for Change
<b>Grace's Warbler</b>	Clumps of mature ponderosa pine/pine-oak forests, yellow pine, (park-like environments, such as reference condition).	Modify stand structure and density towards reference conditions and restore historic fire regimes.
<b>Western Bluebird</b>	Understory development within openings in ponderosa pine stands	Modify stand structure and density towards reference conditions and restore historic fire regimes.
<b>Ruby-crowned Kinglet</b>	MC (frequent fire) mature forest, overstory.	Modify stand structure and density towards reference conditions and restore historic fire regimes.
<b>Pronghorn</b>	Grasslands	Restore historic grasslands by reducing tree encroachment and restoring fire.

## ***Other Sources of Direction***

The Endangered Species Act (1973) <http://epw.senate.gov/esa73.pdf>.

Migratory Bird Treaty Act (1918) <http://www.fws.gov/laws/lawsdigest/migtrea.html>

Recovery Plan for the Mexican Spotted Owl  
[http://www.fws.gov/southwest/es/mso/critical\\_habitat/recovery\\_plan.htm](http://www.fws.gov/southwest/es/mso/critical_habitat/recovery_plan.htm)

Partners In Flight-Arizona Bird Conservation Plan (1999)

Various MOUs are in place with other agencies and organizations to promote conservation of migratory birds, to recover California Condor, , and to facilitate survey and monitoring of bats and bat habitat with Bat Conservation International, improve coordination between AZ Game and Fish and the Forest Service Southwestern Region.

## **Rare and Narrow Endemic Species**

Some species face threats simply by virtue of their relatively limited distribution. Species (or subspecies) are considered to have a restricted distribution if they are limited in extent in the Southwest. A species is considered to be a Narrow Endemic if it has extremely limited distribution and/or habitat in northern Arizona. Due to limited distributions and potential susceptibility to perturbations, some species may require specific management considerations. On the KNF there are 73 species for which restricted distributions is considered a threat, of these, 47 are narrow endemics (See Appendix XX for details).

## ***Desired Conditions for Rare and Narrow Endemic Species***

- There is habitat and refugia for narrow endemics or species with restricted distributions and/or declining populations.
- Location and conditions of rare and narrow endemic species are known.

## **Guidelines for Rare and Narrow Endemic Species**

- Project design should incorporate measures to protect and provide for rare and narrow endemic species where they occur.

## **Management Approach**

Species specific information and management recommendations can be found in the Kaibab endemic species guidebook, which is to be maintained as a living document, updated with new information and locations as it becomes available. When available and not cost-prohibitive, seed and plants used for revegetation should originate from genetically local sources. Seed should be collected in accordance with seed zones or breeding zones. Consideration should be given to using long-term storage facilities for collected seeds such as the seed banks with the Colorado Plateau Native Plant Initiative.

## **Other Sources of Direction**

Conservations Agreements for *Pediocactus* and Bugbane

*[See also Natural Waters, Caves, Cliffs and Rocky Features, the *Pediocactus* Conservation Land Management Area, and the Arizona Bugbane Botanical Area]*

## **Non-Native Invasive Species**

Invasive species are threat to native species, ecosystem function, and the quantity and quality of forest goods and services. The primary threat of invasives are plants such as bull thistle, cheatgrass, knapweeds, and Dalmatian toadflax. These plants have made significant increases in their overall population size in the plan area over the last 10 years. Leafy spurge, yellow starthistle, and the knapweeds (Russian, diffuse, and spotted) are of particular concern due to their invasiveness. These plants tend to outcompete native plants and form monocultures. Invasive weeds have been documented to alter soil temperature, soil salinity, water availability, nutrient cycles and availability, native seed germination, infiltration and runoff of precipitation, fire severity and frequency. The alteration of physical conditions and disturbance regimes allow the invasive species to spread further. The forest also has known populations of invasive animals including bull frogs and crayfish, which have the potential to adversely affect ecosystem function.

## **Desired Conditions for Non-Native Invasive Species**

- Invasive species are contained and controlled so that they do not disrupt the structure or function of ecosystems.
- Visitor experiences are not adversely impacted by the presence of invasive species.
- New populations are detected early, monitored, and treated as soon as possible.

## Guidelines for Non-Native Invasive Species

- All ground disturbing projects should assess the risk of noxious weed invasion and incorporate measures to minimize the potential for the spread of noxious and invasive species.
- Treatment approaches should use Integrated Pest Management (IPM) practices to treat noxious and non native invasive species. IPM includes manual, biological, mechanical, and herbicide/pesticide treatments.
- Pesticide/herbicide use should minimize impacts on non-target flora and fauna.

## Management Approach

Strategies to prevent the spread of non-native invasive weeds and includes education, inventory, and control guidelines. Educational programs that increase weed awareness are critical for effective management of weeds. Weed treatments focus on those species that pose the greatest threat to biological diversity and watershed condition. In order to effectively manage invasive weed populations, it is important to coordinate with other agencies, grazing permittees, and adjacent land owner to prevent and control weeds.

Invasives are most effectively managed through prevention and use of “Best Management Practices”. Many of these practices avoid activities that would provide vectors for non-native species to spread (e.g. water and vehicles used in fire suppression).

## Other Sources of Direction

See Appendix B-Design Features, Best Management Practices, required Protection Measures and Mitigation Measures of the *Final Environmental Impact Statement for Integrated treatment of Noxious or Invasive Weeds*.

## Soils and Watersheds

Watershed condition is integral to all aspects of resource management and use. Good watershed management maintains the productive capacity of soils, protects water quality and quantity, sustains native species, provides beneficial uses, and reduces the threat of flood damage to Forest Service infrastructure and downstream values.

On the KNF, there are 127 sixth level hydrologic unit boundary watersheds. Roughly two-thirds of these are in fair to excellent condition. Watershed conditions have been generally static over the last 20 years. Some portions of watersheds have been improved through tree thinning and managed fires while other areas continue to increase in more dense forest conditions. The primary risk to watersheds is uncharacteristic fire. Watersheds containing departed vegetation types are at higher risk of erosion and sedimentation following uncharacteristic fire, as well as a downstream risk of sedimentation.

## **Watershed Desired Conditions**

- Vegetation conditions within watersheds contribute to downstream water quality and quantity.
- The fuels composition within watersheds does not put the watersheds at risk for uncharacteristic disturbance.
- Flooding maintains normal stream characteristics (e.g., water transport, sediment, woody material) and dimensions (e.g., bankfull width, depth, slope, sinuosity). Floodplains are functioning and lessen the impacts of floods on human safety, health, and welfare.
- Water quality meets or exceeds State of Arizona or Environmental Protection Agency water quality standards for designated uses. Water quality meets critical needs of aquatic species.

## **Guidelines for Watershed Management**

- Projects design should include appropriate best management practices (BMPs) to protect and improve watershed condition.
- In disturbed areas, erosion control measures should be implemented as necessary to improve soil conditions.
- Revegetation projects should use native species and locally collected seed when practicable.

## **Management Approach**

The Forest Service and Arizona Department of Environmental Quality (ADEQ) share the common objective of improving and protecting the nation's waters. ADEQ serves as the designated Management Agency within the context of the Arizona Water Quality Management Program for all NFS lands within the KNF.

The KNF coordinates with ADEQ to ensure Forest Service projects meet the requirements of State Water Quality Management Plans and the Non-point Source Management Program developed pursuant to federal regulations and the Clean Water Act.

## **Other Sources of Direction**

MOU with State of Arizona

Forest Service Manual 2500 – – Service Wide Issuance WATERSHED AND AIR MANAGEMENT

Region 3 (Southwestern Region): Regional Issuances

Forest Service Manual 2504.3 Exhibit 01

Forest Service Manual 2510 - WATERSHED PLANNING

Forest Service Manual 2520 - WATERSHED PROTECTION AND MANAGEMENT

Forest Service Manual 2530 - WATER RESOURCE MANAGEMENT

Forest Service Handbook – Service Wide Issuance

Forest Service Handbook 2500 – Watershed and Air Management

## Region 3 (Southwestern Region): Regional Issuances

- 2509.13 - Burned-Area Emergency Rehabilitation Handbook
- 2509.16 - Water Resource Inventory Handbook
- 2509.21 - National Forest System Water Rights Handbook
- 2509.22 - Soil and Water Conservation Handbook
- 2509.23 - Riparian Area Handbook
- 2509.24 - National Forest System Watershed Codes Handbook
- 2509.25 - Watershed Conservation Practices Handbook

*[See also Forestry and Forest Products]*

## ***Desired Conditions for Soils***

- Ecological and hydrologic functions are generally not impaired by soil compaction.
- Soil function and inherent long-term productivity are sustained so that the soil can support desired native vegetation, resist erosion, recycle nutrients, and absorb water.
- Soil condition rating (See Glossary) is satisfactory where potential exists.
- Soils are stable within their natural capability. Vegetation and litter limit rills, gullies, pedestalling, excessive soil deposition, and topsoil loss.
- Soils provide for diverse native plant species. Vegetative ground cover is well-distributed across the soil surface to promote nutrient cycling and water infiltration.
- Accelerated soil loss is minimal, especially on sensitive or highly erodible sites.
- Logs and other woody material are distributed across the surface to maintain soil productivity.
- Biological soil crusts (mosses, lichens, algae, liverworts) are present where appropriate, and are stable or increasing in semi desert grasslands, desert, Pinyon-juniper and sagebrush communities.

## ***Management Approach***

Watershed protection was one of the primary reasons for establishing the National Forests. Forested lands absorb precipitation, refill regional underground aquifers, sustain watershed stability and resilience, and provide aquatic and wildlife habitat. The highest risk to watersheds is uncharacteristic wildfire. Actions that restore the natural vegetative and fuels composition would reduce susceptibility of large-scale watershed disturbances and provide for watershed protection over the long term.

## ***Other Sources of Direction***

Vegetation Ecology (use of native plants in revegetation, rehabilitation, and restoration) – FSM 2070.3

Region 3 FSH 2509.22 Chapters 10-40 Soil and Watershed Conservation Practices.

FSH 2509.22 Soil and Water Conservation Practices Handbook.

Refer to FSH 3509.18 Soil Management Handbook.

## Biogeologic and Constructed Features

### Caves and Mines

Caves and mines provide habitat for species that require these specialized niches for roosting and overwintering, particularly for bats. Bats are important to cave ecosystems, especially large roosts. Cave ecosystems rely almost entirely on the surface for nutrients. As a result, bats deposit considerable amounts of surface nutrients into caves via guano. Because of this, the presence of bats can support an entire ecosystem. Consequently, cave-roosting bats are often considered keystone species. Eighteen bat species are known to regularly use caves in the American Southwest, and Arizona is home to all cave-roosting bats occurring in the southwest. Many caves also have important traditional cultural significance to area tribes.

### Desired Conditions for Caves, Karst and Mines

- Caves maintain moisture and temperature levels consistent with historic conditions.
- Archeological, geological, and biological features of caves and mines are not disturbed by visitors.
- Caves, karst features and abandoned mines provide quality habitat for bat species. Disease is within natural levels.
- Mine closures do not compromise habitat for species that require specialized niches for roosting and overwintering (e.g., bats).

### Guidelines for Activities for Caves, Karst, and Mines

- Project design should include protections for subsurface geologic features where they occur.
- In caves or mines, decontamination procedures should be followed for preventing the spread of White-nose Syndrome (WNS) as set forth by the USFWS and Western Bat Working Group.
- Caves containing endemic species should be managed for the protection of that species over other uses.
- Before closing caves or mines, they should be inspected by a biologist who is certified for entering caves and mines to determine if bats are using these areas. If roost sites are present develop closure structures that will allow the bats to continue to use the cave or mine such as wildlife friendly bat gates that meet Bat Conservation International (BCI) recommendations.

### Management Approach

There is increasing evidence that the WNS syndrome can be transmitted by human activities and that a cave/abandoned mine environment containing this fungus is infectious to hibernating bats. The Forest implements BMPs for containment and decontamination to reduce the transfer of *Geomyces destructans*. The KNF collaborates with the USFWS, Bat Conservation International and the AGFD to address conservation management for bat species, including the development of

a response plan for White Nose Syndrome. A complete an inventory of caves and associated endemic species is needed on the KNF to inform management.

Work with wildlife, public affairs, recreation, invasive species, cave and mine staffs; and State and other Federal agency partners; involved publics, such as local caving groups; to internally and externally develop and launch White-nose Syndrome (WNS) awareness campaigns at local and regional levels.

### ***Other Sources of Direction***

WNS implementation guide:

[http://www.fws.gov/northeast/pdf/WNS\\_SDM\\_Area\\_3\\_user\\_guide\\_2009.pdf](http://www.fws.gov/northeast/pdf/WNS_SDM_Area_3_user_guide_2009.pdf)

Decontamination Procedures for Use on National Forest System Lands To Help Prevent the Spread of White-Nose Syndrome Associated with Cave and Abandoned Mine Entry.

Western Bat Working Group (WBWG): The Bat Grid White-Nose Syndrome Decontamination Protocol.

The USFWS White-Nose Syndrome Decontamination Protocols for Researchers

### **Cliffs and Rocky Features**

#### ***Desired Conditions for Cliffs and Rocky Features***

- Cliff ledges provide cover and nesting habitat for wildlife such as snakes, bats, birds, and small mammals (e.g. American peregrine falcon, California condor).
- Rocks and rocky areas promote seedling germination and maintain cover for vertebrate and invertebrate species.
- Rock climbing and related recreational activities do not disrupt the life processes of rare or threatened species or diminish the function of specialized vegetation, such as mosses, lichens, and fleabanes.
- Rockslides and talus slopes are natural, undisturbed features that provide habitat for wildlife such as lizards, snakes, and land snails.

#### ***Guidelines for Cliffs and Rocky Features***

- Activities involving heavy machinery or blasting should minimize impacts to habitat associated with rocky features and cliffs.
- Near known active raptor nest sites, temporary closures and use restrictions should be implemented for rock climbing and other potentially disruptive activities.
- Where recreation activities have the potential to trample known populations of narrow and endemic plant species, signs should be posted educating the public to stay on designated trails and avoid impacts.
- Talus slopes should be surveyed for endemic species prior to authorizing quarrying rock hounding, or construction activities that may alter them.

## Cultural Resources

The Kaibab National Forest is rich in historically and culturally significant heritage properties. To date, approximately 30% of the Forest has been surveyed for heritage resources and over 9,600 archaeological sites have been identified and documented. These heritage properties are related to a long history of human occupation and use of the Forest dating back at least 12,000 years. Such sites include preceramic lithic scatters associated with Archaic hunter-gatherers, pithouse and masonry structures associated with early farmers, historic sites related to Native American and early Anglo-European use of the area, numerous petroglyph and pictograph sites, and traditional cultural properties. To date, forty-four historic properties on the Kaibab have been listed to the National Register of Historic Places for their historic significance and more than 2,400 additional sites have been determined to be eligible for inclusion to the National Register.

### *Desired Conditions for Cultural Resources*

- Cultural resources including known traditional cultural properties, are preserved, protected, or restored.
- Historic artifacts are preserved in situ or, when necessary, curated following current standards.
- All heritage properties are evaluated for their eligibility to the National Register and properties significant in American history are listed to the National Register of Historic Places as appropriate.
- Cultural resource findings will be synthesized and shared with the scientific community and public through formal presentations, publications, and educational venues.
- The public is educated on the cultural history of the Forest and historic preservation issues.
- The Forest's historic documents, including photographs, maps, journals, and Forest Service (FS) program management records, are available to the public for research and interpretation.

### Objectives for Cultural Resources

- A "Passport in Time" project is hosted every year.
- At least 20 interpretive presentations are provided to the public each year.
- Provide, produce, or assist in at least 1 scientific presentation, publication, or research project each year.
- Memoranda of Understanding are developed and maintained (every 5 years) with federally recognized tribes to address issues related to consultation and historic preservation.
- Non-project related Heritage survey is conducted in areas with a high likelihood of historically significant heritage properties on at least 100 acres per year.



## ***Guidelines for Cultural Resources Protection***

- The purposeful excavation of human remains for educational purposes such as research or field schools should be not be permitted.
- The Forest should ensure that archaeological projects conducted on the Forest address topics of known importance to tribes as necessary and appropriate.

## ***Management Approach***

The Forest will continue to work to identify, evaluate, and protect heritage resources. Collaborative partnerships and volunteer efforts that will assist the Forest in historic preservation will be developed and maintained. The Forest will be proactive in protecting cultural resources from adverse impacts and will conduct outreach to educate the public on the history of the Kaibab and historic preservation issues. The Kaibab will continue to work with federally recognized tribes to protect ancestral sites and manage cultural resources appropriately.

## ***Other Sources of Direction***

Archaeological Resources Protection Act

National Historic Preservation Act

Memoranda of Understanding with tribes

FSM 2360.2

FSH (in prep)

First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities Among New Mexico Preservation Officer, Arizona State Historic Preservation Officer, and Texas State Historic Preservation Officer and Oklahoma State Historic Preservation Officer and the Advisory Council on Historic Preservation and the United States Department of Agriculture Forest Service Region 3 and supporting protocols.

Native American Graves Protection and Repatriation Act

E.O. 13175- Consultation and Coordination with Tribal Governments

## Traditional Cultural Properties

A Traditional Cultural Property (TCP) is a type of historic property under the National Historic Preservation Act that defined as “eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community’s history, and (b) are important in maintaining the continuing cultural identity of the community”. In Northern Arizona, TCPs are predominantly, but not necessarily, associated with American Indian tribes or communities.

### ***Desired Conditions for Traditional Cultural Properties***

- Traditional practitioners have access to TCPs for ceremonial use and privacy to conduct ceremonies.
- TCPs are preserved, protected, or restored for their cultural importance and are generally free from inappropriate impacts.
- The significant visual qualities of TCPs are preserved consistent with the TCP designation.
- Traditional use of TCPS by associated communities is accommodated by the Forest.
- Confidential and or sensitive information regarding TCPs is protected by the Forest.

### ***Guidelines for Traditional Cultural Properties***

- Development of new facilities, commercial and recreational activities should be minimized in TCPS.
- Consultation should be conducted for all proposed specials uses permits within TCPs.

### ***Management Approach***

The Forest continues to work to identify, evaluate, and protect Traditional Cultural Properties and work with associated communities to collaboratively manage TCPs by developing programmatic agreements, management plans, Memoranda of Understanding, or other management tools. Traditional use of TCPs important to maintaining the continuing cultural identity of associated communities and is accommodated and facilitated by the Forest and inappropriate development of TCPs is minimized. The Forest takes an active role in educating the public on the importance of TCPs and issues related to their management while protecting confidential and/or sensitive information regarding TCPs.

Mineral and energy development are generally inconsistent with the desired conditions for Traditional Cultural properties.

### ***Other Sources of Direction***

Farm Bill

## FSH and FSM Specific Sections

Parker, Patricia L. and Thomas F. King, 1998 Guidelines for Evaluating and Documenting Traditional Cultural Properties, National Register Bulletin, US Department of the Interior, National Park Service, National Register, History and Education

*[Additional guidance is found in the Traditional Cultural Uses, Kanab Creek Wilderness, Bill Williams Mountain and Red Butte sections of this plan.]*

## Air Quality

The EPA, as required by the Clean Air Act (1990) has established National Ambient Air Quality Standards (NAAQS) for six pollutants to protect human health, as well as to protect against decreased visibility, damage to animals, crops, vegetation, and buildings.

Prescribed fires and ignition operations on wildfires are the management activities most likely to cause temporary decreases in the air quality of the airsheds in Northern Arizona. The NAAQS pollutant of concern is fine particulate matter, both PM10 and PM2.5. Studies indicate that 90 percent of smoke particles emitted from wildland fires are PM10, and about 90 percent of PM10 is PM2.5 (2.5 microns in size or smaller).

Federal agencies in Arizona fund a Smoke Management Group that is housed in the Arizona Department of Environmental Quality (ADEQ) offices. This group assembles and coordinates planned burning activities from all federal agencies on a daily basis, and works closely with officials in ADEQ to approve or disapprove burning activities to help ensure compliance with both health and visual NAAQS.

Much of the Forest is departed from its historic fire frequency. By not burning periodically, accumulated fuels contribute to a greater amount of emissions when large uncharacteristic severe wildfires occur. Prescribed burns, as well as many of the management ignition operations on a wildfire, are implemented when ventilation conditions are favorable, and other emission reduction techniques are in place. They generally produce far fewer emissions than the uncharacteristic severe wildfire behavior they are designed to deter. Over time, as re-entry with fire occurs, the reduced fuel load will result in lower emissions per acre when burned.

## ***Desired Conditions for Air Quality***

- Management activities on the Forest are coordinated with the Arizona Department of Environmental Quality, as well as with adjacent agencies, to best maintain and protect the air quality in the airsheds of Northern Arizona.
- Management activities do not exceed State or Federal emissions standards.

## ***Guidelines for Air Quality***

- Project design for prescribed burns, and strategies for wildfires should incorporate as many Emission Reduction Techniques, as listed in ARS 18-2-15, as are feasible, subject to economic, technical, and safety criteria, and land management objectives.
- Decision documents for wildfires should identify smoke sensitive receptors, and include objectives and courses of action to minimize and mitigate impacts to those receptors as feasible.

## ***Management Approach***

Management activities implemented to restore fire-adapted ecosystems are likely to increase atmospheric particulates. Coordination with Arizona Department of Environmental Quality (ADEQ) during prescribed burns and wildfires is needed to comply with State and Federal regulatory requirements for emissions and impacts to Class I and II airsheds. Consideration of affected communities, particularly those disproportionately impacted due to their proximity or topography that may result in smoke inversions.

## ***Other Sources of Direction***

Forest Service Manual and Handbook 2500 – Watershed and Air Management

Arizona Revised Statute Title 18-Environmental Quality, Chapter 2-Air Pollution Control, Article 15-Forest and Range Management Burns (2004)

<http://www.azdeq.gov/environ/air/smoke/download/prules.pdf>

## **Forest Uses, Goods, and Services**

NFS Lands were reserved with the intent of providing multiple uses, goods, and services to satisfy public needs over the long-term. The following section describes the desired conditions and strategies for meeting this intent.

## **Recreation and Scenery**

The natural, cultural, and scenic environment of the KNF offer settings for a wide range of high quality recreation opportunities. The forest provides quiet, mountain, forested, and high desert places to escape from urban environments and pursuits, and enjoy cooler temperatures. Cultural features provide historic context to the natural scenery adding to the richness to these places. Scenic areas and associated outdoor recreation provide places to hike, bike, fish, hunt, view wildlife, drive for pleasure, and enjoy the peace, quiet and spiritual values of nature.

The Kaibab provides both frontcountry and backcountry opportunities. The frontcountry is composed of outdoor areas that are easily accessible by vehicle and heavily visited by day-users. Frontcountry locations include developed areas, tend to be more crowded, and attract a wider range of visitor than backcountry. Recreation Opportunity Spectrum (ROS) classes of Urban, Rural, some Roaded Natural and Roaded Modified characterize front country areas.

Backcountry are the more remote recreational areas that are not easily accessed, and used primarily by overnight visitors (i.e. backpackers). ROS classes of Semi-primitive Motorized,

Semi-primitive non-motorized, primitive, and some Roaded Natural and Roaded Modified designations characterize backcountry areas.

### ***Desired Conditions for Recreation and Scenery***

- The biological, cultural, and scenic environment is sustained and enhanced for present and future generations.
- Recreation settings have healthy, sustainable vegetation, water, and lands. Multiple use management activities occur
- The forest provides a diverse range of high quality, sustainable recreation settings and corresponding high quality scenery consistent with public demand and resource capability emphasizing locally popular dispersed and developed recreation places and those important to the tourism industry.
- Non-Wilderness Recreation front country and back country areas provide a range of different recreation opportunities for forest users and are balanced with the ability of the land and management to support them. User conflicts are infrequent.
- Recreationists recognize their part and share in the responsibility for conserving natural and cultural resources.
- Recreation use levels are compatible with natural quiet, scenery, cultural, soil, vegetation, water, wildlife and other resource values.
- Information and education programs are provided and result in increased forest stewardship, partnerships and volunteerism.
- Opportunities for OHV (off-highway vehicle) riding and driving for pleasure are available on the designated system of forest roads and motorized trails. OHV use is compatible with non-motorized recreation.

### ***Recreation Desired Conditions for Front Country***

- Front Country areas provide initial contact points for forest users and developed recreation settings where people can engage in a variety of recreation activities including scenic driving, hiking, camping, picnicking, fishing, and boating. Motorized and non-motorized recreation opportunities are available.
- Service Centers such as District Offices, visitor information centers, developed campgrounds and other staffed recreation sites are located in communities and along primary forest access corridors and scenic byways.
- Front country areas are capable of supporting moderate to high visitor use.
- Forest Service staff, concessionaires, partners, and/or volunteers operate and maintain the sites and are available on a regular basis or seasonally to provide information and education. Front country sites are orderly and patrolled as needed to provide visitor security. Formal interpretive programs are provided, as well as opportunities for self-guided nature study.
- Constructed facilities in front country settings provide for user comfort and resource protection. They blend in with the surrounding land often incorporating naturally occurring or well matched building materials in their construction. The number and size of constructed facilities is appropriate for the use and activities that occur at each site.
- Recreation settings retain high to moderate scenic quality. Some human-made elements in the background are present.
- Developed campgrounds meet the needs of vehicle-based camping. The overall capacity of campgrounds meets demand at high use seasons including large groups.
- Artificial waters provide opportunities for fishing, natural quiet, wildlife viewing and in some cases for camping and boating. A variety of hiking opportunities exist.
- The existing recreation term permits such as golf courses, ski lodges, and resorts are economically viable and adequately serve forest visitors so that no new ones are needed.

### ***Recreation Desired Conditions Back Country Areas***

- Developed trailheads and viewpoints provide a transition and orientation place for forest users as they enter Back Country areas. Constructed facilities in these settings provide natural resource protection. Facilities are few in number, use the minimal area needed, and have simple construction designs that blend in with the surrounding area and are made of native materials or other well matched materials.
- Back Country areas are mostly undeveloped places where people can engage in a variety of more primitive recreation activities.
- Main access corridors to NFS lands and contact points such as developed trailheads and viewpoints have information available. Visitor use in the back country is moderate and disperses from these points.
- Visitors can find information about available recreation opportunities in the area. Informal interpretive and educational information is available at secondary visitor contact points and focus on appropriate use of the Kaibab NF and incorporate natural and cultural resource conservation messages.
- Back Country areas are generally free of facilities. Informal pullouts and minimal signing provide access to areas such as a forest trail, a walk to a scenic vista, or wildlife viewing location.
- Users have low to occasional contact with other visitors. Visitors rely on their outdoor skills and provide their own equipment as they engage in recreation activities.
- Forest users are occasionally contacted by Forest Service personnel and are regularly patrolled.
- Back Country recreation settings retain high to moderate scenic quality in most locations.
- Areas adjacent to private land, wilderness, some back country areas (semi primitive non-motorized, semi-primitive motorized) provide opportunities for natural quiet and spiritual values.
- Visitors have access to information that enriches their recreation experiences and contributes to an understanding of their role in public land stewardship. “Leave No Trace” and “Tread Lightly” and archeological resource protection principles are promoted and practiced by the visiting public.
- Forest visitors are familiar with natural processes and the evolving role of humans in natural systems. Conservation education actively engages children and adults.

## ***Guidelines for Activities Affecting Recreation Opportunities***

The Kaibab National Forest Recreation Opportunity Spectrum and Scenery Management Guidebook should be used for recreation management and project design.

The Recreation Opportunity Spectrum (ROS) class and Scenic Integrity (SI) map (See Recreation Suitability) should be followed, with these exceptions:

- In Semi-Primitive (Motorized and Non-Motorized), no more than 25% of an individual area should be mechanically treated at one time.
- In Roaded Natural, more than 25% of an individual area may be treated if treatment activities cause minimal visual impacts and/or the treated area recovers within the “high” scenic integrity timeline. Treated areas must achieve the assigned ROS class and corresponding scenic integrity before further large scale treatments in the area may be initiated. This exception is not intended to limit the size of fires managed for resource benefits.
- In Roaded Modified, over 25% of an individual area may be considered if treatment activities cause minimal visual impacts and/or treated area recovers in the “high” scenic integrity timeline. Treated areas must achieve the assigned ROS class and corresponding SI before further large scale treatments in the area may be initiated. This exception is not intended to limit the size of fires managed for resource benefits.
- In Rural, over 25% of an individual area may be considered if treatment activities cause minimal visual impacts and/or treated area recovers in the “high” scenic integrity timeline. Treated areas must achieve the assigned ROS class and corresponding SI before further large scale treatments in the area may be initiated. This exception is not intended to limit the size of fires managed for resource benefits.

## ***Guidelines for Activities Affecting Scenery***

The Kaibab National Forest Recreation Opportunity Spectrum and Scenery Management Guidebook should be used for recreation management and project design.

- In areas of Very High Scenic Integrity, projects should be completed within one year.
- In areas of High Scenic Integrity, projects should be completed within one year, but they may temporarily drop one level during critical project or management activities.
- In areas of Moderate Scenic Integrity, projects should be completed within two years, but they may temporarily drop one level during critical project or management activities.
- In areas of Low Scenic Integrity projects should be completed within three years. Timeline may be extended, but the scenic integrity may not drop below this level.



## **Standards for Recreation Activities**

- Areas within one mile of developed campgrounds, cabin rentals, administrative sites, East Rim Overlook are closed to camping.
- Competitive OHV and motorized events are not permitted on the forest.
- Motor vehicle use beyond the designated system of roads, trails, and areas, as defined on Motor Vehicle Use Maps (MVUM's) is prohibited, except for those uses authorized by law, permits, and orders in connection with resource management and public safety.

## **Guidelines for Recreation Activities**

- Any new motorized trailheads should be located in Front Country areas, incorporate or convert existing roads, protect open space, and protect natural and cultural resources.
- New trail development (motorized and non-motorized) should include partners, and/or cooperators for trail development, maintenance and visitor contacts for information and education.
- Group uses should be concentrated in Front Country areas.
- Resource impacts should be reduced in Front and Back Country by directing camping to existing dispersed campsites, and if needed, campsites should be designated. Pack-it-in Pack-it-out practices should be used in all Forest Service managed facilities and dispersed sites not managed under permit.

*[Additional guidance for recreation resource management is found in the Recreation Suitability, Bill Williams Mountain and Developed Recreation Land Management Area direction sections of this plan]*

## **Management Approach**

The KNF works with interested governmental partners, conservation groups, recreation and trail-user groups and local citizens to provide facilities, information, interpretation and education, and other resources for forest users. Mutual cooperation is needed with AGFD to enforce OHV and Game and Fish laws. Coordination with Grand Canyon National Park, Coconino County, and the State of Arizona compliments their roles in providing outdoor recreation.

Recreation is part of a sustainable environmental system that utilizes internal and external collaborative approaches to integrate resource management solutions and environmental protection needs across the landscape. One of the identified needs is to effectively manage dispersed camping, especially at concentrated use areas such as viewpoints. Work with Volunteers and patrols to effectively manage trash on the forest.

Due to the nature of motorized, equestrian, and bicycle trail use, regular maintenance is needed. Partners, volunteers and a fee system would help to provide the revenue for maintenance materials, operation, education and enforcement of regulations. Volunteers and partners play a key role in sharing the importance of managing and protecting our National Forests for our children and grandchildren to enjoy.

As the population in Northern Arizona and the popularity of mountain biking and OHV use continues to grow, the pressure for more trails will likely increase. Any new trail development would need to strike a balance between opportunities for different types of recreation and other resource concerns.

Management activities ensure that the scenery quality is maintained or improved so that nearby vegetation, rock and water features appear natural and human-made elements reflect and compliment natural features. Conservation of these areas helps our economy, retains jobs, and preserves valued ways of life.

The Kaibab places emphasis in the areas where specific niches have been identified. As such, dispersed recreation opportunities on the North Kaibab Ranger District emphasize non-motorized trail and wilderness opportunities.

### ***Other Management Direction***

The KNF Recreation Opportunity Spectrum-Scenery Management Guidebook, Kaibab National Forest Recreation Facility Analysis, Forest Service Built Environment Design Guide, ROS Book, 2300 FSM and Handbook, Landscape Aesthetics Handbook for Scenery Management and National Forest Landscape Management series, and Forest Service Outdoor Recreation Access Guide and Forest Service Outdoor Trail Access Guide provide additional guidance. FSH on trail classification.

### **Traditional and Cultural Uses**

The Kaibab National Forest recognizes that area tribes have cultural ties and knowledge about the lands now managed by the Forest Service and that they have important roles in the stewardship of the land. Tribes with aboriginal territories and traditional ties to the land now administered by the Forest include the Havasupai Tribe, the Hopi Tribe, the Hualapai Tribe, the Kaibab Band of Paiute Indians, the Navajo Nation, the Yavapai-Prescott Indian Tribe and the Pueblo of Zuni. The Kaibab National Forest shares boundaries with the Havasupai and Navajo reservations and is in close proximity to numerous tribal communities. Tribal members visit the Kaibab to gather medicinal plants and for other traditional and cultural purposes. The Kaibab recognizes the importance of maintaining these traditions to area tribes and accommodates traditional use of the Forest by American Indians compliant with existing laws and regulations.

### ***Desired Conditions for Traditional and Cultural Uses***

- Forest leadership recognizes that all lands managed by the Forest were once tribal lands.
- Traditional uses such as the collection of medicinal plants and wild plant foods are recognized as important uses.
- Traditionally used resources are not depleted and are available for future generations.
- Tribal members have access to sacred sites for individual and group prayer and traditional ceremonies and rituals. There are opportunities for solitude and privacy for ceremonial activities.
- The Forest provides a setting for the education of tribal youth in culture, history, and land stewardship and for the exchange of information between tribal elders and youth.

## ***Guidelines for Traditional and Cultural Uses***

- Activities and uses should be administered in a manner that is sensitive to traditional American Indian beliefs and cultural practices.
- The temporary closure authority of Food, Conservation, and Energy Act of 2008 SEC8104 should be used to accommodate traditional use.
- Tribal traditional use of medicinal plants and other botanical resources should take priority over applications for commercial harvesting.
- Important traditional use resources should be monitored to ensure healthy sustainable plant populations available for traditional uses.

## ***Management Approach***

Establishing and maintaining strong, mutually beneficial working relationships with tribes is critical to the future success of the Forest in addressing tribal issues related to land management. The Forest continues to use a shared stewardship approach to land management based on meaningful consultations with area tribes. The Forest and area tribes have a mutual interest in maintaining healthy, sustainable populations of plants and other resources important for traditional and cultural purposes.

The Kaibab continues to work with tribes to identify, collaboratively manage, and monitor these resources and supplement the Forest plant guidebook to contain more detailed information about culturally important plants. The Forest works to accommodate traditional use of the Forest and balance traditional use needs of tribes with the long-term protection of forest resources. Tribal relationships and communication may be enhanced through volunteer opportunities and employment of tribal members. The Forest works with other land managers to develop consistent and clear policy across boundaries regarding traditional use whenever possible.

## ***Other Sources of Direction***

Memoranda of Understanding with Tribes  
Food, Conservation, and Energy Act of 2008  
American Indian Religious Freedom Act  
Religious Freedom Restoration Act  
Executive Order 13007 Indian Sacred Sites  
Forest Service Manual 1563 and Forest Service Handbook 1509.13

## ***Livestock Grazing***

Western lifestyles associated with ranching and livestock grazing has long been a part of the landscape. These historic and contemporary uses have become symbols of independence and contribute to the sense of place. Many people living in the local communities participate in or have connections to ranching and identify with the associated values.

During World War II, Congress demanded as much protein as possible from these rangelands and many areas were grazed unsustainably. Kaibab National Forest made major reductions in authorized livestock from the 1950's through the 1970's in an effort to balance forage production with capacity. Further adjustments to grazing management have been made through site-specific

NEPA analysis and decisions on all allotments. Currently the Forest manages the range resource to balance livestock numbers with forage capacity.

### ***Desired Conditions for Livestock Grazing***

- There are opportunities to engage in ranching activities and graze livestock on NFS lands which contributes to the social, economic, cultural and stability of rural communities.
- Grasses and forbs provide adequate forage for permitted livestock consistent with other desired conditions.
- Allotment fencing allows for passage of animals prone to movement restrictions such as pronghorn antelope.

### ***Guidelines for Livestock Grazing***

- Livestock management should favor the development of native cool season grasses and forbs.
- As opportunities arise, establishment of forage reserves should be considered to improve flexibility for restoring fire adapted ecosystems and range management in times of drought.
- New construction and reconstruction of fences should have a barbless bottom wire and be at least 18 inches high.
- Annual operating instructions for livestock grazing permittees should ensure livestock numbers are balanced with capacity and address any relevant resource concerns (e.g. forage production, weeds, fawning habitat, soils, etc.) and make adjustments as appropriate.
- Post-fire grazing should not be authorized until range readiness is confirmed by range staff. This is when soil and perennial plants (that would likely be grazed) would not be permanently damaged by livestock. The range management definition for this is range readiness (see Glossary).
- Livestock browsing in aspen areas should only be authorized at levels that do not adversely affect the long term health of an individual aspen stand.
- Livestock grazing in and around wetlands should be evaluated on an allotment specific analysis. Mitigation measures should be implemented as needed to minimize potential livestock effects such as deferment when soils are wet and fencing (full or partial).
- The use of montane meadows for heavy livestock gathering should be minimized when soils are saturated to reduce grassland impacts. When no other options are available, use should be rotated annually.

### ***Management Approach***

Adaptive management is being used in our recent projects by using monitoring to maintain and improve the rangeland resources. In general, the KNF continues to keep grazing at conservative use levels (30– 40%). This grazing intensity, based on % use of forage by weight, should provide for plant integrity, density, diversity and regeneration over time.

To make adjustments for changing conditions, the annual operating instructions (AOI) are reviewed and adjusted. The AOIs are the means by which adjustments of livestock numbers, change of season of use, and pasture rest periods are made in response to monitoring information such as frequency, canopy cover, Parker Three-Step plots and allotment inspections. Grazing intensity (measured before the end of the growing season) in combination with other factors such as weather patterns, likelihood of plant regrowth, and previous years' utilization levels is used in determinations. Numbers may go up or down annually but are not to exceed the maximum number set in the site specific decision. Project involving new or modified fences, corrals, salt stations, and artificial waters sources promote healthy wildlife interaction and movement. Deferred-rotation grazing with a special emphasis of deferment during the spring may be necessary to manage towards desired conditions.

Working together with permittees, partners, universities, professional organizations, and volunteers play an important role in achieving and maintaining desired conditions.

### ***Other Sources of Direction***

Congress directs the Forest Service to allow livestock grazing on suitable lands (Multiple Use Sustained Yield Act of 1960, Forest and Rangeland Renewable Planning Act of 1974, Federal Land Policy and Management Act of 1976, National Forest Management Act of 1976).

Regional Forester Order (date) stating that the Havasupai tribe shall have first rights to the Rain Tank Grazing Allotment permit.

*[See also the desired conditions for vegetation, Livestock Grazing section of the Forest Monitoring plan (Chapter 5)]*

## **Forestry and Forest Products**

NFS Lands were reserved with the intent of providing goods and services to satisfy public needs over the long-term. Among these goods is the production of a sustainable supply of forest products. The focus of the Forest Service has broadened over time and the desired conditions for this plan are focused on outcomes rather than outputs. As a result, there are no specific timber volume outputs desired for the Forest. Rather, timber production activities are tools that economically contribute to restoring and maintaining ecosystem diversity and supporting a viable wood products processing industry over the long term. Therefore, some level of regulated forest production is appropriate from forested lands.

The loss of the region's wood harvesting and utilization infrastructure is a critical impediment to the implementation of large-scale mechanical thinning treatments necessary for prompt and effective restoration or fire-adapted forests. Although there are initial signs of emerging small-scale operations, the development of a competitive market for the wood fiber removed by restoration-based treatment is needed. Without the establishment of a viable industry, it is unlikely that forest restoration will occur on a scale that will produce the needed widespread improvements in ecological health or reduction in the risk of anomalous, high intensity wildfire.

### ***Desired Conditions for the Forestry and Forest Products***

- Wood products (e.g. wood pellets for home and industrial heating, oriented strand board, animal bedding, wood molding, pallets, structural lumber, firewood, post and poles, biomass for electricity) and other products (e.g., Christmas trees, boughs, wildflowers, mushrooms, grasses, seeds, nuts, cones, etc.) are available to businesses and individuals in a manner that is consistent with other desired conditions on a sustainable basis within the capacity of the land.
- A sustainable wood harvesting and utilization industry exists of a size and diversity needed to effectively and efficiently restore and maintain the ponderosa pine and frequent fire mixed conifer communities.
- Timbers are available to local American Indian tribes to for traditional uses, such as kiva beams.

## ***Guidelines for Vegetation Management Activities***

- Projects in forested communities that change stand structure should generally retain at least historic frequencies of trees by species across broad age and diameter classes at the mid-scale. As such, the largest and oldest trees are usually retained.
- In frequent-fire PNVTs, spatial patterns of trees should be groupy, providing sufficient canopy breaks to limit crown fire spread between groups and allow for the re-development and maintenance of a robust understory.
- Project design should manage for replacement structural stages to assure continuous representation of old growth over time.
- Project design and treatment prescriptions should generally retain:
  - Large, old ponderosa pine trees with reddish yellow wide platy bark, flattened tops, with moderate to full crowns and large drooping or knarled limbs (e.g. Thompson's age class 4, Dunning's tree class 5 and/or Keen's tree class 4 (A and B).
  - Mature trees with large mistletoe brooms suitable for wildlife nesting, caching, and denning, except where retaining such trees would prevent the desired development of uneven aged conditions over time .
  - Large snags, partial snags and trees with broken tops, sloughing bark, lightning scars >4" wide, and large stick nests.
  - Known bat roost trees.
- The location and layout of vegetation management activities should effectively disconnect large expanses of continuous predicted active crown fire and improve habitat connectivity.
- Vegetation management activities should meet or exceed goals for scenic beauty (scenic integrity objectives) by creating natural patterns, structure and composition of trees, shrubs, grasses and other plants.
- In ponderosa pine and dry mixed conifer, groups of 3-5 reserve trees should be retained in management-created openings larger than 1 acre. In wet mixed conifer and spruce-fir, groups of 6 reserve trees should be retained within management-created openings greater than 0.5 acre. Reserve trees should generally be selected from older dominant or co-dominant classes.
- Post-settlement trees should generally not be retained in former openings.
- Vegetation treatments should favor the development of native understory species in areas where they have the potential to establish and grow.
- Seed and plants used for revegetation should originate from genetically local sources where practicable.
- On suitable timberlands, projects should retain somewhat higher frequencies of trees across broad diameter classes to allow for future tree harvest.
- Montane meadows should not be used as staging areas for logging operations or heavy equipment.

## ***Guidelines for Personal Fuelwood Collection***

Only the following should be permitted for personal-use fuelwood gathering:

- Dead and downed ponderosa pine, Douglas-fir and spruce, juniper, pinyon pine, Gambel oak, or aspen.
- Standing dead:
  - Ponderosa pine, Douglas-fir or spruce less than 12 inches DBH or less than 15 feet in total height
  - Juniper without green foliage
  - Pinyon pine less than 12 DRC (10" DBH) or less than 12 feet in height
  - Gambel oak: less than 8 inches DBH
  - Aspen, less than 12 inches DBH
- Live trees specifically designated by the Forest Service.

## ***Management Approach***

Forestry program contributes to achieving and maintaining vegetation desired conditions. Fuelwood collection can be used as a tool for reducing fuels prior to thinning and burning activities.

In project design, it is important to consider the effect of tree densities on understory abundance and diversity since these components have been shown to be intimately and inversely correlated, at least in the ponderosa pine community on or near the KNF. Most biological diversity in ponderosa pine and frequent fire mixed conifer forest is found in forest understories. Additionally, a robust understory is essential in carrying frequent, low-intensity fires with relatively low smoke emissions.

Project design for thinning and planting can be used to create “living snow fences” for shade and snow accumulation, wind protection slow snow melt and protect from sublimation caused from prevailing winds. Incorporation of such design features can increase resiliency and help offset the effects of climate change.

In areas where oak and associated woody oak habitat components are limited, site specific planning and permits may limit the amount and type of oak that can be collected.

Forest managers work with public outreach and education specialists to convey the significant role that dead and dying trees, downed and woody debris have in maintaining wildlife habitat and critical ecological processes (e.g. Animal Inn program, ([http://www.fs.fed.us/r6/nr/wildlife/animalinn/communicate the value](http://www.fs.fed.us/r6/nr/wildlife/animalinn/communicate%20the%20value)))

[See also *Vegetation Types, Wildlife, Invasive Species*]

## ***Large Scale Disturbance Events in Forested Communities***

There has been a trend toward more large scale disturbance events such as large stand replacing fires and/or bark beetle epidemics. There is a need for a consistent, efficient, scientifically-based response to these events as they are likely to occur during the planning period. Following large-scale disturbance events, the desired conditions for the area would generally not change, except in



cases where the environment has been so altered that the desired conditions are no longer obtainable. However, objectives and guidelines are needed to protect existing resources and set conditions on a trajectory toward desired conditions. In most cases, there is a need to manage toward desired fuel loads and tree densities so that regeneration and reforestation investments are protected from future fires.

### ***Guidelines Following Large Scale Disturbances***

- Threats to human safety and property, such as signing and temporary closures, should be promptly addressed following large disturbance events.
- Mitigating erosion control feature should be implemented to protect significant resource values and infrastructure such as stream channels, roads, structures, and archeological/historic sites.
- Where extensive tree mortality results from fires, insect epidemics, or wind events and sufficient timber value exists, salvage of dead trees should be considered to achieve the desired fuel levels and help fund the restoration and recovery work.
- An adequate number of snags should be retained to provide benefits for wildlife and coarse woody debris for soil and other resource benefits. Some clumps of large (18 inches dbh) standing dead trees should be retained. Snag retention should be balanced with desired fuel levels over time.
- Where conifer seed sources are absent or poorly distributed, artificial regeneration should be implemented to promote the desired forest structure and accelerate the recovery of habitat conditions for native wildlife species.
- Practices that restore nutrient cycling and stabilize soils such as revegetation, mulching, lop and scatter, etc. should be implemented.
- Recreation Opportunity Settings should be considered when developing proposals to respond to large scale Disturbances address and quantity of management actions that may be proposed.
- Recovery and restoration projects design should seek to establish a trajectory toward desired conditions.

### ***Management Approach***

When the uncharacteristic fires occur, the characteristic landscape can take more than 100 years to become restored regardless of management activities. It is important for project design criteria to include both short and long-term provisions for restoring scenic integrity, especially in sensitive foreground areas.

*[See also Recreation and Scenery, Non-native Invasives, relevant Vegetation types]*

### **Wildland Fire Management**

The Guidance for the Implementation of Federal Wildland Fire Management Policy (2009) provides much of the current Direction for the management of fire on Federal lands. This document provides definition of wildland fire used in this Plan.

*Wildland Fire describes any non-structure fire that occurs in the wildland. Wildland fires are categorized into two distinct types:*

- *Wildfires – Unplanned ignitions including human and naturally caused fires. This includes prescribed fires that have been declared escaped wildfires.*
- *Prescribed Fire – Planned ignitions.*

Most of the vegetation on the Forest is adapted to recurring wildfires started by lightning from spring and summer thunderstorms. Frequent, low-intensity fire plays a vital role in maintaining ecosystem health of much of the pinyon juniper, the ponderosa pine, and the dry mixed conifer vegetation types. These three vegetation types alone cover over 80 percent of the Forest. The grasslands are also adapted to frequent fire. Other vegetation types, such as pinyon-juniper-sagebrush, mesic mixed conifer, and spruce-fir, are also fire dependent, but have a historic fire regime of less frequent, mixed severity fires.

The condition and structure of most of Northern Arizona's forests, woodlands, shrublands, and grasslands have changed dramatically from reference conditions. Today the Kaibab National Forest contains uncharacteristically dense forests with many more young trees than were present historically. Ponderosa pine, spruce, fir, juniper and pinyon seedlings have invaded forest openings, grasslands and savannahs. The forest and woodlands are deficient in grasses, forbs, and shrubs due to tree competition, and are at high risk for insect and disease outbreaks. With the denser interlocking canopy cover and accumulated live and dead woody material, the probability and occurrence of large, uncharacteristic, stand-replacing fires continues to increase. These fires burn with more intensity, have higher tree mortality, degrade watersheds, sterilize soils, and threaten homes and communities.

Entry with fire during appropriate weather and fuel moisture conditions is the most cost effective way to reduce the likelihood of a high severity fire. A single fire entry, with low to moderate fire behavior, reduces high severity fire potential for five to ten years in ponderosa pine and dry mixed conifer, and other vegetation communities in Fire Regime 1. With repeated entry with fire within the historic fire frequency interval, the risk of a high severity fire could be kept to a minimum indefinitely, if it were not for the handful of day per year that fire danger indices are at their peak. With few exceptions, the large high severity fires on the Kaibab in the past decades have occurred when fire danger indices were at least above the 90th, and often, above the 97th percentile. To achieve a forest that is resilient to fire disturbance even on those 97th percentile days, forest structure must be restored using activities such as thinning and tree harvesting that reduce tree density and canopy cover. They must be strategically placed to best protect values at risk since they are costly, and the capacity to perform these activities across the landscape does not exist.

Implementing prescribed burns, and managing wildfires to maintain and enhance resources is not without risk. Mechanical treatments, before implementation, have a highly predictable outcome, but fire is a much less precise tool. Unforeseen weather events occur; decisions made with the best of intent are occasionally found, in hindsight, to be based on incomplete or incorrect data. When managing fires over days or weeks, the odds increase that the fire area will experience days of hotter, drier or windier weather; such weather can produce undesirable fire effects on those days such as high severity openings, or threats or damage to resources, private land and property. Despite these risks, the risk of doing nothing is worse, resulting in large, costly, uncontrollable

wildfires; such fires result in landscape scale high severity fire effects that take hundreds of years to regenerate, or convert to an entirely different vegetation community altogether.

### ***Desired Conditions for Wildland Fire Management***

- Wildland fire maintains, and enhances resources and, as nearly as possible, is allowed to function in its natural ecological role. Regular fire entry protects social, economic, and ecological values at risk from high severity disturbance effects.
- Wildland fires burn within the range of intensity and frequency of the historic fire regime of the vegetation community. Uncharacteristic high severity fires rarely occur, and do not burn at the landscape scale.
- Wildland fire is understood, both internally and by the public, as a necessary natural disturbance process integral to the sustainability of the Forest's fire adapted vegetation communities.

### ***Standards for Wildland Fire Management***

- Human caused wildfires will be suppressed at the lowest cost with the fewest negative consequences with respect to firefighter and public safety.
- Managers will use a decision support process to guide and document wildfire management decisions.

### ***Guidelines for Wildland Fire Management***

- Decision documents for wildland fires that progress past initial attack should include interdisciplinary input to assess site specific values at risk, develop project or incident objectives, and courses of action to enhance or protect those values.
- Input should be sought from local specialist on risk of noxious weed invasion, and appropriate objectives and mitigation measures developed for all planned or ongoing wildland fires.
- Decision documents for wildland fires should include objectives to minimize fire created openings to those within the reference range of variability for the vegetation community. Associated courses of action to address those objectives should also be developed.
- Decision documents for wildland fires should address wildlife desired conditions for key habitat features that provide structural diversity such as snags, large oaks, and oak thickets. Associated courses of action or management practices to address those objectives should also be developed.
- If current or anticipated fire behavior and fire effects exceed the desired fire behavior and effects, protection objectives should be developed, or a more conservative prescription window produced. Strategies and tactics to mitigate those effects should be implemented on active wildland fires.

## **Management Approach**

Objectives for wildland fires are developed based on fuel conditions, current and expected weather, current and expected fire behavior, topography, resource availability, and values at risk. Social understanding and tolerance will also affect objectives, as well as adjoining governmental jurisdictions having similar or differing missions and directives.

Wildfires may be concurrently managed for one or more objectives. Objectives can change as the fire spreads across the landscape; parts of a fire may be managed to meet protection objectives, while other parts are managed to maintain or enhance resources.

In areas not highly departed from Desired Conditions, wildland fires are managed to burn with the intensity and frequency of the reference fire regime when fire weather conditions are appropriate, and resources are available to successfully meet objectives.

In areas moderately to highly departed from desired conditions, somewhat higher fire intensities, and the associated fire effects may be acceptable or even desirable at the fine scale, to move fire behavior towards Desired Conditions. Multiple small areas of high mortality are preferred over a single large, high severity event.

Fire is one tool in the process of restoring the Forest's fire adapted ecosystems; in areas departed from reference conditions it is ideally integrated with mechanical treatments that further restore forest structure. In some areas, however, fire may be the only viable tool. Examples of such areas are steep rugged terrain where the high cost and hazards preclude mechanical treatment, or in remote areas of the forest where the distance to high values does not justify the expenditure of limited funds and work capacity. Fire can be successfully used in these areas to treat Forest lands at the landscape scale, and at a minimal cost. Objectives allowing for higher fire intensities, and higher levels of mortality may be needed in these areas to achieve the structural change that will not occur through other means.

Responses to wildfires are coordinated across jurisdictional boundaries whenever there is potential for managing an incident or a burn on more than one jurisdiction (e.g. Grand Canyon National Park, Coconino National Forest). This is done with the understanding that fire adapted ecosystems span jurisdictional boundaries. The value of maintaining and enhancing resources on one side of the fence is augmented when it extends to the other side. Likewise, a fire producing undesirable fire effects is likely to be unwanted on either side of the boundary line.

*[See also forestwide direction for each vegetation type, Livestock Grazing., Air Quality, Wildlife, and the Wildland Urban Interface LMA].*

## **Other Sources of Direction**

Review and Update of the Federal Wildland Fire Management Policy (2001)  
[http://www.nwcg.gov/branches/ppm/fpc/archives/fire\\_policy/index.htm](http://www.nwcg.gov/branches/ppm/fpc/archives/fire_policy/index.htm)

Guidance for Implementation of Federal Wildland Fire Management Policy (2009)  
<http://www.nifc.gov/policies/guidance/GIFWFMP.pdf>

Interagency Prescribed Fire Planning and Implementation Guide (2008)  
[http://www.nifc.gov/fuels/downloads/directions/RXFireGuide\\_08.30.06.pdf](http://www.nifc.gov/fuels/downloads/directions/RXFireGuide_08.30.06.pdf)

Wildland Fire Decision Support System [http://wfdss.usgs.gov/wfdss/WFDSS\\_Home.shtml](http://wfdss.usgs.gov/wfdss/WFDSS_Home.shtml)

Citation for policy to mitigate the potential spread of non-native species (e.g. crayfish, bullfrogs) during water dumps.

## **Special Uses**

Special use permits authorize services that support the Forest Service mission and meet the needs of the public. Permits are a partnership between the Forest Service and private businesses and individuals to provide services and facilities. Special uses authorize occupancy and use of Forest Service lands for appropriate, safe, activities that meet demonstrated public needs when consistent with the desired conditions for the specific area.

### ***Desired Conditions for Special Uses***

- Special Use Permits support and contribute to the forest and district niches.
- Permanent structures associated with special uses are concentrated on existing sites or designated corridors, minimizing the number of acres encumbered by special use authorizations.
- Special use activities blend into the landscape and do not draw attention to the activity or equipment.

### ***Guidelines for Specials Uses***

- Uses should be combined to the extent possible in light of technical and environmental constraints.

## ***Management Direction***

Management of commercial and institutional recreation special use opportunities consider the assessed needs and within area capacity in all ROS classes.

## ***Other Sources of Direction***

Much of the direction that governs special uses on the forest is found in the Forest Service Manual, FSM2700 and Forest Service Handbook, FSH2709.11 & 2709.12. The Initial Screening Criteria and the Second-Level Screening is located in the FSH 2709.11 and 2709.12 for most types of uses. Road use permit information is located in FSM 7731.17.

## Energy Transmission and Electronic Sites

### ***Desired Conditions for Energy Transmission and Electronic Sites***

- Energy corridors provide a reliable supply of energy essential to local, regional, and national economic demands.
- Joint use of rights-of-way and electronic sites is provided and uses are combined to the extent possible in light of technical and environmental constraints.
- Energy transmission lines are not visible (usually underground) across the landscape.
- Vegetative conditions and land uses within energy rights-of-way facilitate the operation and maintenance of the associated facilities and infrastructure. They may differ from the surrounding PNVNT desired conditions in that they generally consist of low-growing or non-woody vegetation. Wildfires are low intensity surface fires, allowing for safe direct attack and continuous operation and delivery of energy

### ***Guidelines for Energy Transmission and Electronic Sites***

- All new communication sites should have a communication site management plan in place prior to the start of operations and must be consistent with forest land management plan.
- The number of electronic sites should be the minimal that is consistent with appropriate public services that require the use of forest lands.
- Environmental disturbance should be minimized by co-locating pipelines, powerlines, fiber optic lines, and communications facilities.
- Existing energy corridors should be used to their capacity with compatible upgraded powerlines, before evaluating new routes.
- When compatible with protection of heritage resources, the use of below-ground utilities should be optimized in order to avoid potential conflicts with wildlife, wildfire, and long-term vegetative management.

### ***Standards for Energy Transmission***

- Major utility corridor development is confined to the area identified and mapped in the West-wide Energy Corridor Programmatic EIS.

*[See also Energy Corridor Land Management Area and Energy Suitability]*

### ***Management Approach***

Energy transmission and electronic sites are permitted and managed through the Special Use authorization process.

### ***Other Sources of Direction***

Other direction for electronic sites is located in FSM 2728, and FSH 2709.11, Chapter 90. For energy transmission is FSM 2726.4 and FSH 2709.11, Chapter 40.

## **Minerals and Energy Development**

Requests to use federal lands for mineral and energy development have rapidly accelerated in the past few years. Most of the requests have been for energy transmission corridors, wind farms, and solar energy development. There have also been requests for uranium exploration and development.

The commercial demand for saleable materials (e.g. flagstone, cinders, etc.) has gone down over the last few years. As the economy recovers the demand for these construction products are expected to increase. There has been a recent increase in the quantity needed for government road projects.

### ***Desired Conditions for Mineral and Energy Developments***

- Minerals and energy developments meet legal mandates to facilitate production of mineral and energy resources on the Forest in a manner that minimizes adverse impacts to surface and groundwater resources, and that do not detract from meeting other desired conditions applicable to the area.
- Important wildlife habitats, visually sensitive areas, habitats of threatened and endangered plants and animals, American Indian sacred sites and areas with large capital investments are protected through project design to achieve and maintain the desired conditions for the area.

### ***Guidelines for Hard Rock Mineral Activities***

- Adverse surface impacts should be minimized through the appropriate administration of mining and mineral laws and regulations. Bare ground necessary to conduct day-to-day operations must be kept to a minimum.
- Restoration and reclamation of surface disturbance associated with mining operations should be implemented to achieve 70% of ground cover (as compared to nearby undisturbed areas) with permanent native vegetation within 3 growing seasons.
- Surface use should be restricted or prohibited in areas with habitat for threatened, endangered and sensitive plant and animal species, and for heritage resources nominated or posted to the National Register. Use and occupancy should be restricted yearlong in areas supporting populations of threatened, endangered and sensitive plant species.

## ***Standards for Leasable and Locatable Mineral Prospecting and Exploration Operations***

- Surface use and occupancy is restricted within foreground of heritage resource sites with National Register status.
- Construction of oil and gas well surface facilities within foreground of heritage resource sites with National Register status in the visible foreground of State Highways is prohibited.
- Oil and gas leases and plans of operations for exploration shall incorporate the following stipulations
  - “Yearlong surface occupancy is prohibited in recreation, administrative and special use sites; on slopes of 15 % or greater, and within foreground of all sites listed on the National Register”
  - “Replanting of areas impacted by operations in tree plantations at the cessation of project is required”

## ***Guidelines for Leasable and Locatable Mineral Prospecting and Exploration Operations***

- On acquired lands where the Forest Service holds the mineral rights, hard rock mineral activities that would remove more than 50 pounds of materials should not be permitted.

*[See also Minerals Suitability]*

## ***Other Sources of Direction***

FSM 2800 (Mining Claims FSM 2810, Mineral Leases FSM 2820, Mineral Materials FSM 2850), FSH 2809.15 and Title 36 CFR part 228, subpart A.

## **Transportation and Forest Access**

The Kaibab NF Transportation System road network consists of thousands of miles of arterial, collector, local, and closed roads ranging from maintenance level 1 to 4. The road system provides access to areas on the Forest including private land, facilities under special use permits, recreational opportunities, research sites, and facilities that support forest and resource management.



## ***Desired Conditions for Transportation and Forest Access***

- Forest roads and trails provide legal and reasonable access for recreation opportunities and resource management. Resource impacts from roads and trails are balanced with the benefits of having the road or trail available for use.
- All designated routes open to wheeled motorized vehicles are shown on a motor vehicle use map that is readily available to the public.
- High-use smooth-surfaced roads provide safe access for low clearance vehicles.
- Low-use roads provide safe access for high clearance vehicles.
- An adequate sign system exists to provide for traveler safety, location information, and compliance.
- The Forest has the road and trail rights-of-way needed to administer the forest and provide public access.
- Wildlife corridors provide for safe and healthy wildlife movement in areas of human development.
- The spatial arrangement of habitat corridors minimizes the potential for vehicular collisions.

## ***Objectives for the Transportation System***

- Within 10 years of plan approval, 15% of non-system roads (user created and decommissioned) are obliterated.
- Grade surfaces, and clean culverts and ditches as needed each year along the maximum amount of open system road mileage feasible, with a minimum goal of 100 miles.

## ***Guidelines for Transportation***

- Motorized uses in Semi-Primitive Non-Motorized designated areas should be restricted, except for necessary minimal administrative activities, permitted activities, and emergency access needs.
- Construction of permanent roads or temporary roads in Semi-Primitive Non-Motorized areas should be avoided unless required by a valid permitted activity. If authorized, roads should be constructed and maintain roads at the lowest maintenance level needed for the intended use.
- Roads should not be located in meadows when they can be located in other areas.
- Roads should be obliterated when no longer needed.
- In areas where subsurface geologic features are prominent, voids should be surveyed for within the proposed alignment prior to road or trail construction.
- Surveys should be conducted to assess bat activity and intensity of use before demolishing and/or modifying structures such as old bridges. If surveys determine that bats are actively roosting in such structures and no alternate bat roost sites exists in the immediate vicinity, project design should include efforts to minimize impacts and to provide for alternate roost sites such as bat boxes where feasible.

## ***Management Approach***

Provide for extensive management of the Forest Transportation System. Make inventories, surveys and analyses, formulate plans, and execute reconstruction, maintenance, and obliteration operations to provide transportation facilities that support resource management and protection and safe public access to National Forest System lands. Provide integration and coordination for transportation and facility management in National Forest land and resource management planning with Federal, State, County, and other local transportation authorities.

Roads that serve year around residents of in holdings are typically turned over to other Public road Agency jurisdictions. In cases when those agencies do not accept Jurisdiction of the road, the Forest Service attempts to enter into road maintenance agreements to apportion the road maintenance according to the amount of use by each type of traffic. This results in some FS roads being maintained primarily by the County, and others being maintained alternately by the County and the FS.

Work closely with the AZGFD, the Arizona Wildlife Linkages Working Group and ADOT to identify wildlife habitat needs, potential barriers to wildlife movement, and to mediate such threats during new projects by designing effective wildlife crossings and travel mitigation areas early in the transportation planning process.

## ***Other Sources of Direction***

*Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-03*, U.S. Department of Transportation. Federal Highway Administration (FHWA).  
*Forest Service Supplemental Specifications to FP-03*, USDA Forest Service.  
*Manual on Uniform Traffic Control Devices* (current edition), as approved by the Federal Highway Administrator as the National Standard.

*Standard Specifications for Transportation Materials and Methods of Sampling and Testing* (current edition and interims, if applicable), AASHTO.

FSH 7709.56 Preconstruction Handbook, USDA Forest Service.

FSH 7709.57 Road Construction Handbook, USDA Forest Service.

FSH 2509.25 Watershed Conservation Practices Handbook, USDA Forest Service.

Arizona Revised Statutes, Article 49, Chapter 2, Article 3.1

Arizona Administrative Code Title 18, Chapter 9, Article 9 and Chapter 11, Article 1

## **Potable Water**

The Kaibab NF currently has 18 potable water systems. These include concessionaire operated, Forest Service operated, and systems on Forest Service land operating under a special use permit. Some of these systems are hauled water systems which receive water from other systems.

The City of Williams has the only municipal water system supplied by a watershed located on the Forest. The watershed is approximately 26,061 acres in size. Most (96%) of this watershed is within the Cataract Creek Headwaters and Dogtown Wash HUC12 sub-watersheds. Citizens of Williams, Arizona depend on this watershed as a source of public drinking water and for other benefits.

## **Desired Conditions for Potable Water**

- The City of Williams Municipal Watershed provides a treatable and reliable source of water.
- Potable water systems are safe for human consumption.

## **Guidelines for Potable Water Systems**

- Qualified Forest Service personnel should conduct routine sanitary surveys on potable water systems to ensure adequate safety, operation, and maintenance of the systems.
- Water system quality documentation from hauled sources should be reviewed monthly.

## **Management Approach**

Supervisors or certified water system operators verify qualifications and/or provide necessary training and designate personnel responsible to operate potable water systems.

The Forest Service enters into agreements with concessionaires or private entities to operate and maintain potable water systems that provide water to facilities on the Forest. These systems are jointly operated by both parties to ensure water quality standards are maintained.

## **Other Sources of Direction**

FSM 7400, Chapter 7420 – Drinking Water, USDA Forest Service.

Arizona Administrative Code Title 18, Chapter 4, 5, 9, and 11.

Arizona Revised Statutes, Article 49, Chapter 2, Article 2 and 9.

## **Lands**

Land adjustments for landownership consolidation and improved management efficiency are the real estate transactions on the Forest including sales, purchases, exchanges, conveyance, and rights-of-way.

### ***Lands Desired Conditions***

- Forest System lands are in a pattern that promotes efficient management. They consist of large contiguous areas that provide efficient and effective resource management and wildlife connectivity within and across National Forest System lands
- Lands identified for disposal and acquisition are displayed on the Land Adjustment Map.
- The public has access to Forest System lands within the Kaibab.

### ***Lands Objectives***

- Public access for all permanent roads and trails within the National Forest boundary is obtained within 10 years of plan approval.

### ***Management Approach***

Work closely with the state, counties, and other Federal agencies to resolve rights-of-way issues and to ensure that public access to the various parts of the Forest on state, county or permanent Forest Service roads meets management objectives for all ownerships.

Work with adjacent landowners to minimize conflicts between public land users and private landowners. Resolve permanent legal public access issues by purchase, exchange, donation and condemnation of rights-of-way.

acquired through land exchange, purchase, or donation.

### ***Other Sources of Direction***

FSM 5420 Land Purchases and Donations, FSM 5430 Exchanges, FSM 5460 Rights-of –Way Acquisition and FSH 5409.13, FSH 5409.17.

Code of Federal Regulations, Title 49, Section 24.102 – Basic Acquisition Policies through Section 24, 104 – Review of Appraisals, and Section 24.108- Donations.

## Chapter 3: Management Areas

This Chapter of the plan contains direction for management areas, which have specific management direction that differs from the general forest. In some cases, there may appear to be a conflict between direction presented at larger and finer scales. If there is an apparent conflict, the direction at the finer scale takes precedence. There are two types of management areas: Special Areas and Land Management Areas (LMAs).

**Special Areas** are land units within the NFS given special designation through statute or a separate administrative process because of their unique or special characteristics. Special areas include areas such as Wilderness, Research Natural Areas, and Botanic Areas. Not all areas designated by statute or other process are automatically treated as special areas in the Plan. Area specific Plan direction is only developed where desired conditions and management differ substantially from those in the surrounding area.

**Land Management Areas** are delineated to aid in management and provide plan direction for specific sites. Land management Areas such as wildland urban interface areas and utility corridors apply to more than one area on the Forest. Others such as Red Butte and Bill Williams Mountain are geographically specific.

### Special Areas

#### Wilderness

Designated Wilderness provides places where natural processes to predominate and the impacts of humans are minimized. These are places that Congress has set aside to pass on to future generations. Wilderness provides large areas for the study of nature and unique scientific and educational opportunities. Wilderness areas are designated by Congress and are:

- " .lands designated for preservation and protection in their natural condition. ." Section 2(a)
- " .an area where the earth and its community of life are untrammelled by man. ." Section 2(c)
- " .an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvement or human habitation. ." Section 2(c)
- " .generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. ." Section 2(c)
- " .outstanding opportunities for solitude or a primitive and unconfined type of recreation. ." Section 2(c)
- " .shall be devoted to the public purposes of recreation, scenic, scientific, educational, conservation and historic use." Section 4(b)

The KNF contains four Wilderness Areas:

### **Kendrick Mountain Wilderness**

Kendrick Mountain Wilderness is a XXX acre area and encompasses Kendrick Peak, one of the highest peaks in the San Francisco volcanic field. In 2000, the entire wilderness was involved in a large wildfire. Fire intensities ranged from light to very severe, with more intensely burned areas most evident on the west, north, and east slopes of the peak. Montane mixed conifer forests are present in the unburned and lightly burned areas. Natural recovery processes are occurring in more intensely burned areas, with aspens and other early seral species becoming established in those areas. Unstable volcanic soils have undergone severe erosion on the steeper slopes within burned areas,

Part of the Kendrick Mountain Wilderness lies on the Coconino National Forest, but the Kaibab Land Management Plan (this plan) contains direction for the entire wilderness area.

### **Kanab Creek Wilderness**

Kanab Creek Wilderness is a 75,300-acre area on the north side of the Grand Canyon. Kanab Creek is a major tributary of the Colorado River, flowing down from its source some 50 miles north in southern Utah. Along the way, Kanab Creek cuts a canyon that drains a large area of deep gorges cut into the walls of the Kanab and Kaibab Plateaus. Elevations vary between 2,000 feet at the Colorado River to about 6,000 feet on the rim. The plateaus above are arid with sparse vegetation while the canyon bottoms are often gorgeous riparian zones. Most of the slopes in this wilderness exceed 40 percent and the canyon walls have been eroded into intricate sculptures of knobs, potholes and fins in many places. The upper areas support desert bighorn sheep, Kaibab mule deer and almost all the chukar partridges in Arizona. The lower regions support lots of reptiles, snakes, birds, and lizards. The Kanab Creek Wilderness contains the only Desert Community and Cottonwood Willow Vegetation communities on the KNF.

*[See also forestwide direction for Cottonwood Willow Riparian and Desert Communities]*

### **Saddle Mountain Wilderness**

Straddling the eastern edge of the Kaibab Plateau the Saddle Mountain Wilderness is a rugged land of narrow drainage bottoms and steep scarps. The gentle slopes on the main ridge of the area drop dramatically to form the Nankoweap Rim on the south. Elevations range from about 6,000 feet on Marble Canyon Rim to 8,000 feet on Saddle Mountain itself, a prominent ridge with a profile that resembles a saddle, horn and all. Utah juniper and pinion pine in the lowlands give way to mixed conifers in the highlands. The only perennial free flowing stream on the KNF, North Canyon Creek, lies entirely within the Saddle Mountain Wilderness Area.

### **Sycamore Wilderness**

Sycamore Canyon is the second largest canyon in the Arizona redrock country. The 21 mile (33.6 km) long scenic canyon reaches a maximum width of about 7 miles (11.2 km). Sycamore Canyon Wilderness is a Class I Airshed and it is located in within the Coconino, Kaibab, and Prescott National Forests.

Note: Management direction for the Sycamore Wilderness is contained in the Coconino National Forest Land Management Plan.

## **Recommended Wilderness**

As part of Forest Plan Revision, there is a process for identifying and evaluating potential wilderness on NFS Lands. Areas determined to meet wilderness capability requirements are considered potentially available for wilderness designation. The determination of availability is conditioned by the value and need for the wilderness resource compared to the value and need for other resources. The Kaibab Wilderness evaluation process identified areas to be managed as recommended Wilderness (See Appendix X Wilderness Evaluation).

## ***Desired Conditions for Wilderness and Recommended Wilderness***

- The environment is essentially un-modified. No services are provided and self-reliance is required. The naturally occurring scenery dominates the landscape. Man-made features are rare and use natural or complimentary materials. Some historic constructed features are present.
- Wilderness provides opportunities for primitive and unconfined non-motorized and non-mechanized recreation and contiguous wildlife habitat. Human encounters are only with individuals or small parties, are infrequent, and opportunities for solitude are common.
- There are enduring, high quality wilderness values while providing for quality wilderness recreation experiences.
- Classified wilderness areas are used within the limits of acceptable change parameters established for each area
- Natural processes are maintained within the wildernesses. Fires function in their natural ecological role.
- Wilderness areas have minimal to no non-native, invasive species.
- Wilderness boundary postings are well maintained.
- Maps and information brochures are up-to date and available to the public.
- A reproducing population of Apache Trout is maintained in North Canyon Creek.

## **Objectives for Wilderness and Recommended Wilderness**

- Inspect and maintain wilderness trails and signs on 10% of the area annually.

## Standards for Wilderness Areas and Recommended Wilderness

- Group size in Wilderness is limited to 12 people.
- Competitive events are not permitted in Wilderness.
- Outfitter Guide permits for hunting will not be issued for overnight use or campsite locations in designated Wilderness.
- Geo-caches are prohibited.

## Guidelines for Wilderness Areas and Recommended Wilderness

- Wildfires should be suppressed below the rim of the Kanab Creek Wilderness.
- Wildland fires should only exceed the wilderness boundary if the objectives of the threatened management area can be met.
- Non-native, invasive species should be treated within wilderness in order allow natural processes to predominate and to avoid the adverse effects of human influences.

## Management Approach

Minimum tool analysis. Ten-year Wilderness Challenge.

Minimum Requirement Decision Guide

## Other Sources of Direction

Wilderness Act of 1964

Forest Handbook and Manual

## Frank's Lake Geologic-Botanic Area

The Franks Lake Geologic-Botanic Area is 145 acres. It is at 8,550 feet elevation and represents a relatively undisturbed example of limestone sinks, or karsts. There are three such sinks within the geologic-botanical area. The three sinks, and their tributary drainage, represent various stages of geologic and vegetative development associated with the Kaibab limestone geology which dominates the Kaibab Plateau. The easternmost sink is known as Franks Lake and contains a grassy meadow and small pond.

In the water, typical plants include bulrush, cattail, and pondweed. Around the edges, grasses and grasslike plants include sedges, rushes and Kentucky bluegrass. The surrounding forest community is characterized by blue spruce, Englemann spruce, ponderosa pine, and quaking aspen. The lake supports nesting mallards, and various shorebirds.



## ***Desired Condition for Frank's Lake Geologic-Botanic Area***

- The natural features are preserved, perpetuating the natural ecologic processes affecting the area.
- There is minimal evidence of human disturbance.

## ***Guidelines for Frank's Lake Geologic-Botanic Area***

- Camping within the fenced boundary of Frank's Lake should not be permitted.
- Livestock should be excluded from the Frank's Lake Geologic Botanic Area..

## **Arizona Bugbane Botanical Area**

This area 490 acre area was established as a botanical area for the protection of Arizona bugbane (*Actea arizonica*), a candidate species for threatened status. It is located in a canyon bottom on the north face of Bill Williams Mountain. Only a few population areas of this plant are known in Northern and Central Arizona. It is found in montane riparian habitats characterized by Douglas-fir, maples, and bracken ferns. A primary threat to this species is trampling by hikers in areas where access to the populations is easy. Uncharacteristic fire is also a threat.

## ***Desired Conditions for the Arizona Bugbane Botanical Area***

- Arizona Bugbane has a sustainable population and is at low risk for extirpation.

## ***Objectives for the Arizona Bugbane Botanical Area***

- Annually inspect the recreation trails and maintain as needed to manage hiking use.

## ***Guidelines for the Arizona Bugbane Botanical Area***

- Arizona Bugbane plants should not be collected, except through scientific permit.
- Trail maintenance and any other potentially disturbing activities in the botanical area should be evaluated and protective measures should be implemented as needed.
- Public information and recreational brochures should not feature this area.

## ***Management Approach***

Arizona bugbane is managed under U.S. Fish and Wildlife Service (USFWS) direction through the Arizona Bugbane Conservation Agreement (USDI FWS et al. 1999). This agreement represents a commitment by the Forest Service and the Fish and Wildlife Service to manage this

species to ensure that it does not become threatened or endangered. The character of this area is maintained by limiting access and managing threats. Suppression actions may be needed to prevent damage to the plant colony and habitat.

### ***Other Sources of Direction***

Arizona Bugbane Conservation Assessment and Strategy for the Coconino and Kaibab National Forests (USDA FS 1995). The character of this area is maintained by limiting access and managing threats. Suppression actions may be needed to prevent damage to the plant colony and habitat.

### **Double A Wild and Free-Roaming Burro Territory**

Wild burros have been known to occupy the area since the late 1800's. A wild burro is a free-roaming, unclaimed, unbranded burro that descended from pack animals that wandered off or were released by prospectors and miners. This territory was established as required by the Wild Free Roaming Horse and Burro Act of 1971 (PL 92-195) and is managed under cooperative agreement with the Bureau of Land Management. The Territory is in the northwestern portion of the Williams Ranger District, in the northern half of the Double A grazing Allotment.

### **Desired Conditions for the Wild and Free Roaming Burro Territory**

- A biologically sound burro population is in balance with native wildlife, permitted livestock, and other resource values.
- The burro herd ranges from 22 to 35 animals.

### **Guidelines for the Wild and Free Roaming Burro Territory**

- Population control measures should be implemented to maintain the desired herd size.

### ***Management Approach***

Population control measures may include capture and fertility treatments.

### ***Other Management Direction***

Wild Free-Roaming Horses and Burros Act of 1971: Forest Service Handbook sections 2263.1 Territory Plans and 2265.3 - Removal of Excess Animals.

### **Kaibab Squirrel National Natural Landmark**

In 1965, 278,459 acres of ponderosa pine forest within the KNF and Grand Canyon National Park were designated as the Kaibab Squirrel National Natural Landmark. National Natural Landmarks (NNLs) are designated by the Secretary of Interior and represent unique examples of ecological and geological features that comprise our nation's natural history. The NNL designation is not a land withdrawal and does not direct or prohibit any activity. Direction for these areas requires federal agencies with NNL designations to consider the unique properties of the NNL in their

planning and impact analysis (Fed. Reg. 64: 25718) and provides opportunities to secure funding and construct partnerships to achieve management and conservation goals. The Kaibab Squirrel NNL was designated for the Kaibab squirrel and for its largely intact example of the western climax community of ponderosa pine.

### ***Management Approach***

The needs for the Kaibab squirrel National Natural Landmark are addressed in the Forestwide direction for the ponderosa pine vegetation type. No specific plan direction has been developed, however, the Forest continues to work collaboratively with the NPS National Natural Landmarks program Intermountain Regional Coordinator as well as other interested parties in developing a better understanding of the habitat use, distribution, and conservation needs of this unique species.

### **Grand Canyon Game Preserve**

The Grand Canyon Game Preserve was established through a Presidential Proclamation by Theodore Roosevelt on June 29, 1906 to protect game species and their habitat on the Kaibab Plateau. The original proclamation does not provide a habitat management prescription, but provides a general statement about the vision. Section one (1) of the Grand Canyon Game Preserve Act states “The Reserve should be set aside for the protection of game animals and be recognized as a breeding place therefore”. The Forestwide plan direction for vegetation, wildlife, and other habitat features is consistent with the spirit of the proclamation. There has been no need identified for more specific plan components. Plan component will be developed as needed informed by the advance of scientific information and societal values.

### ***Management Approach***

The Forest cooperates with the Arizona Game and Fish Department in carrying out the cooperative agreement for the management of the Grand Canyon Game Preserve.

### ***Other Sources of Direction***

Cooperative agreement with Arizona Game & Fish and Region 3, April 30, 1976

### **Kaibab Plateau-North Rim Parkway**

Highway 67 is designated as an Arizona State Scenic Road, a National Forest Scenic Byway, and a National Scenic Byway. Under the National Scenic Byway program, the U.S. Secretary of Transportation recognizes and supports certain roads as National Scenic Byways or All-American Roads based on their outstanding archaeological, cultural, historic, natural, recreational, and scenic qualities. It provides resources to help manage the intrinsic qualities within the broader Byway corridor to be treasured and shared.

The Kaibab Plateau-North Rim Parkway was designated because of its scenic beauty, and natural and cultural qualities. In the Byway nomination, it mentions that Highway 67 is unique in that the entire route is located on National Forest and National Park lands and there is an opportunity to highlight natural resource management activities. The Kaibab Plateau-North Rim Parkway is managed to provide visitors with opportunities to enjoy the outstanding scenery of natural and cultural landscapes on the Kaibab Plateau. The route follows Arizona State Route 67 from Jacob

Lake, AZ to Grand Canyon National Park North Rim. Open seasonally, the parkway travels through ponderosa pine and mixed conifer forests and high country meadows on its way to the Grand Canyon. Wildlife is abundant in the area, including deer, wild turkeys, coyotes, and many bird species.

### **Desired Conditions for the Kaibab Plateau-North Rim Parkway**

- The Kaibab Plateau-North Rim Parkway provides exceptional opportunities for scenic driving. Views along the byway are natural appearing and include a variety of landscape characters including coniferous forest, aspen and other deciduous species, and high elevation meadows. Road corridor improvements and interpretive facilities are designed and constructed to blend well and complement the natural and cultural environment surrounding the byway. Facilities are designed to accommodate people with varying abilities. Forest management activities remain largely un-noticeable.
- Scenic byways exhibit natural-appearing landscapes where human activities do not stand out in the foreground, up to ½ mile (high scenic integrity).

### **Arizona National Scenic Trail**

The Arizona National Scenic Trail (ANST) is a non-motorized, primitive trail that stretches approximately 807 miles from Mexico to Utah across Arizona and is the only national scenic trail in Arizona. It connects deserts, mountains, forests, wilderness, canyons, historic sites, communities and people and passes through some of the most renowned landscapes in the state. The ANST showcases Arizona's diverse life zones and scenery and is enjoyed by a wide variety of non-motorized recreationists, including hikers, equestrians, mountain bicyclists, cross-country skiers, and other outdoor enthusiasts.

There are about 75 miles on the KNF, 25 miles on the Tusayan District and 50 miles on North Kaibab Ranger District. The trail transects the Grand Canyon National Park and connects two segments on the forest.

### **Beale Wagon Road National Historic Trail**

A portion of the historic Beale Wagon Road crosses the Kaibab NF on Williams Ranger District. The historic route led from Fort Smith, Arkansas to the Colorado River and served as an important immigration route to California prior to the Civil War. Lieutenant Edward F. Beale surveyed and constructed the route between 1857 and 1859. In laying out the route, Beale used segments that had been used by indigenous peoples for centuries. The route was largely abandoned when the railroads were established through the area.

The route of the Beale Wagon Road on the KNF is marked by large rock cairns and survey markers. There is no constructed trail tread. Motorized vehicles are prohibited from using the historic trail.

### **Overland Road National Historic Trail**

The historic Overland Road was established in 1863 as a military route connecting Flagstaff, AZ with Prescott, AZ. Much of the route followed older indigenous pathways that skirts rugged Sycamore Canyon. The route was heavily used by the military, migrants and freighters originally, and it continues to be used as a livestock driveway today.

The route of the Overland Road on the KNF is marked by large rock cairns. There is no constructed trail tread. Motorized vehicles are prohibited from using the historic trail.

### **I-40 – Parks Rest Area National Recreation Trail**

The I-40- Parks Rest Area National Scenic Trail is a self-guided interpretive trail located immediately adjacent to the westbound rest area on Interstate 40 , 20 miles east of Williams, AZ. The paved trail provides information about the ponderosa pine forest, Forest Service management and nearby recreation opportunities.

### **Bill Williams Mountain Complex National Recreation Trails**

The Bill Williams Mountain Complex National Recreation Trails are a series of non-motorized trails accessing Bill Williams Mountain. It includes Clover Springs Bypass, Buckskinner, City Link, Benham, Bill Williams, and Bixler Trails. The trails start in the ponderosa pine vegetation type and climb the flanks of the mountain providing panoramic views of the Williams Ranger District. The trails offer a variety of hiking opportunities from moderate to difficult.

#### ***Desired Conditions for National Trails***

- Views in the immediate foreground (0-200 feet) of the Arizona National Scenic Trail include natural-appearing landscapes. The landscapes have high scenic values and are generally appear unaltered by human activities.
- Signing helps long-distance travelers find nearby developed sites, trailheads, recreation facilities, and drinking water sources.
- User conflicts between competing recreational uses are infrequent.

#### ***Guidelines for National Trails***

- Projects should preserve the recreation opportunity setting for any affected segments.
- Special use authorizations for trail segments that receive high public use should be limited.

### ***Management Approach***

The forest works the Arizona Trail Association and adjacent landowners to maintain trail corridors and the condition and character of the surrounding landscape.

A comprehensive plan is currently being developed that will provide management direction for the use of the AZT, including but not limited to specific objectives and practices to be observed in the management of the trail, detail any needed cooperative agreements, and identify carrying capacity of the trail and a plan for its implementation. Until the Comprehensive Management Plan is completed the Forest will manage the trail consistent with the 1995 Arizona Trail Management Guide, where applicable.

Motorized vehicles may be used for trail maintenance and administrative use.

## ***Other Sources of Direction***

FSH 2353.4 – National Scenic and Historic Trail Administration

## **Land Management Areas**

Land Management Areas (LMA) are areas on the KNF with a need for more specific management direction than the general forest. They may be discrete or overlapping. Where there are differences in plan direction, the finer, more restrictive, guidance applies.

## **Wildland Urban Interface Areas**

The Wildland Urban Interface (WUI), in general terms, is the wildland area surrounding resident populations, and other human developments having special significance, that are at imminent risk from wildfire. People are increasingly seeking to live in more secluded lands bordering public lands. At the same time, large high severity wildfires are increasing in occurrence as the conditions of forests become more departed from reference conditions, putting these widely spaced homes, and rural communities at risk. This creates the most dangerous and complex fireline situations that federal, municipal, and rural firefighters face. Desired conditions and guidelines specific to this area are necessary to reduce the risk to firefighter safety, as well as to human developments.

The Healthy Forest Restoration Act (HFRA) of 2003 defines the WUI as an area within or adjacent to an at-risk community that is identified in a Community Wildfire Protection Plan (CWPP). Two CWPPs have been prepared that have large WUI Zones that overlap Kaibab Forest lands. The WUI Zone outlined in the Greater Williams Area CWPP covers all of the forested cover type on the Williams Ranger District, and is 326,000 acres in size. The Tusayan CWPP WUI Zone covers 63,720 acres - nearly 20 percent of the District. The rationale for such large zones is that wildfires in recent history, under critical fire danger conditions, have demonstrated rapid rates of spread over great distances in a single burning period, posing threats to communities and infrastructure miles from the point of origin.

Achieving desired conditions for the entirety of the CWPP WUI Zones is a long term aspiration, but it is outside the capacity of the Forest Service to achieve within the projected life of this Plan. Also, these Zones do not cover many other highly valued human developments at risk on, and adjacent to, the Forest.

For the purposes of this Plan, the WUI Area is refined to a buffer around WUI values to focus more intensive treatments where they will have the most impact for fire protection, and includes the following lands:

- Half mile buffer around all private lands.
- Half mile buffer around administrative sites, fee-use cabins, fire lookouts, developed campgrounds, day use picnic areas, and facilities managed under Special Use Permits.

- Half mile buffer around at risk communication sites. (Those on Bill Williams Mountain are addressed in the Bill Williams Land Use Zone.)

### Desired Conditions for WUI Areas

- Wildland fires in the WUI Area do not result in the loss of life, or property or characteristic ecosystem function.
- Wildland fires in the WUI are low intensity surface fires. Firefighters are able to safely and efficiently suppress wildfires in the WUI using direct attack.
- When WUI intersects with vegetation types with a mixed or high severity fire regime, characteristic ecosystem function is modified to promote low intensity surface fires.
- The desired tree basal area in the WUI is on the lower end of the range its vegetation community.
- Ladder fuels are nearly absent.
- Logs and snags, which often pose fire control problems, are present in the WUI, but at the lower end of the range given in the vegetation community desired conditions.
- Dead and down fuel load is between 1 and 5 tons per acre. This light fuel load is desirable even in vegetation types with higher reference fuel loads, such as wet mixed conifer, to provide improve fire protection to human developments deemed to have special significance.
- Openings between tree groups are of sufficient size to discourage isolated group torching from spreading as a crown fire to other groups.
- Openings with grass/forb/shrub vegetation occupy the mid to upper end of the percentage range in the desired conditions.  
Trees within groups may be more widely spaced with less interlocking of the crowns than desirable in adjacent forest lands.

### Management Approach

Firefighters need more open stands, with few ladder fuels, and low fuel loadings, where wildfires drop to the surface before they reach the values at risk. Treatments in the WUI Area are designed to provide this zone where firefighters, can safely perform direct attack on undesirable wildfires. The more open stand conditions also serve to protect Forest lands from human caused fires started on private lands because firefighters can more readily contain a wildfire before it burns into denser, more flammable vegetation in the Forest at large.

While fire protection is the key objective in this Area, other resource objectives are also met, and the integrity of the ecosystem is maintained. Treatments are guided by the same Forest-wide desired conditions for forest resources, goods and services as outside the zone, but lands within the WUI Area are managed to achieve the more open end of the desired conditions for the vegetation community.

A half mile buffer around human developments is the starting point for determining where more open, intensive treatments occur. This distance is recommended in the HFRA (2003), and

provides a distance conducive for passive crown fire to transition to surface fire. During project specific planning, the area where more intensive treatments are needed may call for adjustment. Continuous steep slopes, continuous heavy fuels, or other fire hazards may indicate a need to expand more open treatments. On the other hand, sound reasons for retaining more dense stands may exist, such as habitat for a narrow endemic species, and call for a less intensive treatment, no treatment, or moving the buffer area to the outside or around the more densely stocked area.

All private lands, whether or not they contain human improvements, or the type of improvements they contain, are treated as WUI. In doing so, making subjective value judgments on different structures is avoided. It also accounts for the potential that any given private in-holding could be developed during the lifespan of the Plan.

Due to variable budgets, market capacity, and workforce capacity, achieving desirable structural changes through planned mechanical treatments is sometimes delayed or occurs sporadically. Projects that include lands in the WUI should allow flexibility in the order of treatment implementation. This allows fire managers the option to burn prior to mechanical treatments, greatly reducing fire hazard in the WUI Area in the interim until mechanical treatments take place.

Including maintenance burning in project design is essential to securing the investment made in thinning and initial entry burns. Without maintenance burning the fire protection value from treatments is largely lost within 40 to 50 years due to increased fuel loads and more densely stocked stands.

Well-planned trails at the urban interface provide sufficient legal access between Forest system trails and neighborhoods reducing the potential development of user-created social trails.

*[See also Vegetation Communities, Wildland Fire Management]*

### West-wide Energy Corridor

Two corridors were identified in the West-wide Energy Corridor Record of Decision (ROD) that cross the forest. One on the Tusayan RD, corridor # 47-68, follows the APS K-9 500 kV line, Four Corners SES, which crosses the southern portion of the district. The other corridor is located on the Williams RD, corridor # 61-207, which follows the APS K-13 500 kV line, Navajo Project Line, across the district from the southwest to the northeast. These corridors were defined in the ROD as being 3500 feet wide with the centerline identified as the center of existing transmission line easement and is open to both pipeline and transmission line development (See Appendix XX. LMA map). Both of these corridors were identified in the present LMP as areas to allow expansion for major utility lines. The PEIS identifies potential energy corridors; evaluates effects resulting from their designation; identifies mitigation measures of potential effects anticipated from future development; and includes the Interagency Operating Procedures (IOPs) applicable to the planning, construction, operation, and decommissioning of future projects within the corridors. The environmental consequences of future projects will be addressed in project-level NEPA analyses. While the PEIS constitutes compliance with NEPA for the decision to designate energy corridors on NFS lands in 10 western states, **it does not authorize specific ROW projects.** Future development within the corridors would need to meet appropriate NEPA requirements and comply with other applicable laws, regulations, and policies.



Currently, the Navajo Transmission Project, a multi-agency NEPA process is underway, proposing to add a 500 kV line parallel to, and immediately south of, the Four Corners SES line on Tusayan RD.

*[See also Energy Transmission and Electronic Sites and Energy Suitability]*

### **Developed Recreation Sites**

This LMA totals 1,556 acres and includes the 15 major existing public and private sector developed recreation sites and other smaller sites (trailheads, interpretive sites, etc.) Many visitors to the Forest campgrounds and lodges come from the Phoenix metropolitan area for climatic relief from extreme summer temperatures.

Most campgrounds in the Williams unit are adjacent to impoundments that offer water oriented recreation activities. Most of the fishing use on the Forest occurs in this LMA. All fish are stocked by Arizona Game and Fish Department. With the exception of White Horse Lake, all of these impoundments are water storage facilities for the City of Williams. Campground capacity is established to ensure preservation of water quality.

### ***Desired Conditions for Developed Recreation Sites***

- Developed campgrounds are places where structures and human-caused vegetation changes may be seen but they do not dominate the view or attract attention (low to moderate scenic integrity).
- Human activities in the areas visible from campgrounds (foreground to middle ground, 300 feet to 4 miles) do not attract attention or stand out and the landscapes appear natural (moderate to high scenic integrity).
- Volunteer hosts are provided at all public sector fee campgrounds.

### ***Objectives for Developed Recreation Sites***

- Reconstruct or construct at least one-quarter of developed campsites as small group sites within 10 years of plan approval.
- Reduce developed site recreation deferred maintenance by an average of 5% each year.

## ***Guidelines for Developed Recreation Sites***

- The 14-day stay limit should be enforced in all public sector development sites during the operating season.
- Reconstruction and improvements of private sector developed sites should be within current site capacity allocations.
- Surveys should be conducted to assess bat activity and intensity of use before demolishing and/or modifying structures such as old buildings. If surveys determine that bats are actively roosting in such structures and no alternate bat roost sites exists in the immediate vicinity, project design should include efforts to minimize impacts and to provide for alternate roost sites such as bat boxes where feasible.
- Developed Recreation Site vegetation management plans should guide thinning and burning activities in the campgrounds.

*[Additional Guidance is found in the Recreation and Scenery section of this plan.]*

## **Garland Prairie Research Natural Area**

Garland Prairie Research Natural Area (RNA) is a 300 acre area on the Williams Ranger District that was identified as a potential RNA in the original Forest Plan but was never officially designated. Research Natural Areas are a part of a national network of field ecological research areas established for the purpose of non-manipulative research, observation, and study. They are selected and established to preserve a wide spectrum of pristine areas that typify important habitat types and serve to preserve and maintain genetic diversity, maintain baseline or reference areas for the study of ecologic changes, and as a control to other similar habitats being manipulated for research or management purposes.

This area is typical of the high elevation grassland ecotone dominated by Arizona fescue and mountain muhly. Historically, this area was grazed by sheep and cattle, but there are no range improvements. Boundary fences have excluded livestock since about 1989. This Land Management area will be recommended as a research Natural Area

## ***Desired Conditions for Garland Prairie RNA***

- The area serves as a reference for the study of ecologic changes, and as a control to other similar habitats being manipulated for research or management purposes
- Lightning fires are able burn naturally within the area.

## ***Objectives for Garland Prairie RNA***

- Inspect the boundary fence annually and maintain as needed.

## ***Guidelines for Garland Prairie RNA***

- The area should be protected from activities that directly or indirectly modify ecologic processes.

## ***Management Approach***

After establishment, guidance for this area would be moved to the “Special Areas” section of the plan. Once established, use of the area by responsible scientists and educators is encouraged. Research would then need to be coordinated with the Rocky Mountain Forest and Range Experiment Station under a cooperative agreement or special use permit.

There is a regional need for Research Natural Areas for specific vegetation types (pinyon-juniper woodland, ponderosa pine forest, semi-desert grassland, montane and cottonwood-willow riparian forests, wetland/cienega riparian areas, and quaking aspen). The Kaibab National Forest has the potential to fill these needs. Currently, the Kaibab is evaluating a possible site in the ponderosa pine vegetation type in the area of Lookout Canyon on the North Kaibab Ranger District. The Forest will consider proposals for other potential RNAs in other underrepresented categories.

## **Bill Williams Mountain Land Management Area**

Bill Williams Mountain has been identified as an LMA because it contains multiple resources and uses of high natural, cultural, and economic value. It is eligible as a Traditional Cultural Property, and has been identified as a “sacred site” by American Indian tribes. It contains a Mexican Spotted owl Protected Activity Center, the Arizona Bugbane Botanic alArea, communication towers that serve the Arizona Department of Public Safety, the U.S. Customs and Border Protection, and the Federal Aviation Administration. There is a ski area, a fire lookout tower, and historic trails. The watershed makes up a large portion of the municipal water supply for the City of Williams and contains the headwaters of Cataract Creek, which flows into Havasupai.

This LMA has the highest values areas per acre on the KNF with regard to both economic and amenity values. It is at high risk for uncharacteristic wildfire due to its steep slopes, dense vegetation, and high fuel loading. If a large wildfire occurred within the area, it could adversely affect many valuable resources.

## ***Desired Conditions for the Bill Williams Mountain LMA***

- The risk is low for substantial damage to municipal water supply, infrastructure, water quality, visual quality, and cultural integrity (e.g. tribes and local communities)
- The risk of damage to electronic sites is low and communications related to the site is uninterrupted.
- Bill Williams Mountain provides quality habitat for Arizona Bugbane, Mexican spotted owls, and culturally important plants.

## ***Objectives for the Bill Williams Mountain LMA***

- Implement a fuels reduction project within 5 years of plan approval.

## ***Guidelines for Activities in the Bill Williams LMA***

- The existing term permit for the Elk Ridge Ski Area on Bill Williams Mountain should be restricted to the existing established permit area.
- High use roads within the Municipal watershed should be maintained to prevent erosion and sedimentation.
- Commercial plant collection within the Bill Williams LMA should not be permitted.
- Vegetation treatments immediately adjacent to the Arizona Bugbane Botanical Area should leave enough tree cover to maintain the cooler temperatures and higher humidities.

## ***Standards for Activities in the Bill Williams LMA***

- Artificial snow making within the Bill Williams LMA will not be permitted.

## ***Management Approach***

Due to the complexity of the multiple high values and stakeholders, project planning would best be served by a collaborative process. The seasonality of uses, access, and resource needs call for coordination and consideration of timing of implementation in project planning.

The highest priority for fuel reduction treatment is the north and east slopes due to the potential risk and consequences of a high intensity wildfire. Steep slopes and concerns about erosion and sedimentation may call for treatments to either treat fuels in place, or use cable or aerial harvest systems. Other priority areas for treatments are in the Wildland urban interface.

*[See also Traditional Uses, Special Uses, Vegetation, Wildlife, Wildland Fire Management]*

## **Red Butte Land Management Area**

This land management area has been identified as an area particularly important to several American Indian tribes. It is eligible as a Traditional Cultural Property, and has been identified as a “sacred site” by American Indian tribes. Management of this area is to be consistent with that designation. TCP boundaries are largely confidential and difficult to identify on the ground. This Land Management Area boundary was selected due to its manageable area boundary that encompasses the geologic formation of Red Butte.

## Desired Conditions for Red Butte LMA

- The environment is essentially un-modified. The naturally occurring scenery dominates the landscape.

## Guidelines for Red Butte LMA

- Mitigation measures should be used to avoid conflicts with ceremonial activities.
- Temporary closures should be implemented upon request by the tribes to provide privacy for traditional activities.
- The helipad on Red Butte should only be used for administrative use.
- Commercial use such as outfitter guides, plant collection, and fuel wood in the Red Butte LMA should not be permitted.

## Management Approach

Tribal members have identified air traffic surrounding Red Butte as disruptive to tribal ceremonies. Because the Forest Service does not have the authority to regulate air traffic (flights), it is important that the Kaibab works closely with and educate potential operators about the impacts. When temporary closures are in place for traditional /ceremonial use, a request air operators to avoid the area may be made.

This area is currently open for mineral entry, however mining is generally incompatible with the desired conditions of the area. The Red Butte LMA is within the proposed Northern AZ Mineral Withdrawal DEIS analysis area. If this area is not withdrawn in the ROD, the Kaibab would recommend this area for withdrawal.

*[See also Recreation Setting for Semi-primitive non-motorized]*

## Buffalo Ranch

The bison herd is owned and managed by the state of Arizona on NFS lands land through an agreement between the Arizona Game & Fish Department and the US Forest Service.

## Desired Conditions for the Buffalo Ranch

- Bison are a desired introduced species in the designated area in Houserock Valley.
- There are opportunities to hunt buffalo (bison).
- The bison herd size ranges from 75 to 90 head post-hunt.

## Guidelines for the Buffalo Ranch

- Bison should be confined to the area identified in the MOU.

## **Management Approach**

The KNF recognizes the historical significance of bison on the North Kaibab Ranger District. The bison herd has been present on the district for more than 100 years and was specifically mentioned in legislation leading to the Grand Canyon Game Preserve.

Coordination and cooperation between the KNF, AGFD, Grand Canyon National Park, and researchers will be needed to identify workable solutions for managing the bison.

## **Pediocactus Conservation Area**

*Pediocactus paradinei* (which is also known as the Paradine or Kaibab plains cactus) was previously a Category 1 candidate for listing as Endangered by the USFWS. In lieu of formal listing, an interagency Conservation Assessment and Strategy was prepared for the Paradine plains cactus (*Pediocactus paradinei* B.W. Benson). This management area was established to aid in the management of this species.

## **Desired Conditions for the Pediocactus Conservation Area**

- *Pediocactus paradinei* has a sustainable population and is at low risk for extirpation.

## **Guidelines for the Pediocactus Conservation Area**

- Collection of *Pediocactus paradinei* plants should not be permitted.
- Project activities should incorporate protective measures for the Paradine plains cactus. Any potentially ground disturbing activities in the Pediocactus Conservation area should be evaluated and protective measures should be implemented as needed.
- Non-native invasive weeds should be regularly monitored and promptly treating
- Motorized access should be restricted
- Public information and recreational brochures should not feature this area.

## **Management Approach**

The character of this area is maintained by limiting access and managing threats. Suppression actions may be needed to prevent damage to the plants and habitat.

# Chapter 4: Suitability

Suitability is the appropriateness of applying certain resource management practices to a particular area of land in consideration of the relevant social, economic, and ecological factors. Suitability is determined based on compatibility with desired conditions and objectives in the plan area. The identification of an area as suitable for various uses is guidance for project and activity decision making, and is not a commitment or a final decision approving projects and activities.

## Timber Suitability

The National Forest Management Act requires that NFS lands be classified as to their suitability for timber production. NFS lands were reserved with the intent of providing goods and services to satisfy public needs over the long-term. Among these goods is the production of a sustainable supply of forest products. Timber production is the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees for industrial or consumer use. Timber production activities can contribute to social, economic or ecological sustainability. For example, timber production may offset some or all of the costs of thinning activities that lower uncharacteristic fire and insect risk, increase understory plant diversity and abundance, and create employment opportunities.

Areas unsuitable for timber production are those where it is either not desirable or feasible to manage for periodic harvests of forest products. For example, restoration of grasslands often requires cutting trees. These trees can be made available for sale, but the intent for the future is to maintain them as grasslands. In this case, timber production is not desirable. Where long-term resource productivity would be impaired or law, regulation or policies prohibit it, timber production is not feasible.

**Table 2. Timber Suitability**

<b>Timber Suitability Category</b>	<b>Acres</b>
<b>All NFS Lands within Plan Area</b>	<b>1,542,064</b>
Non-forest Lands <sup>1</sup>	206,365
Withdrawn Lands	117,563
Irreversible Resource Damage	38,700
Adequate Restocking not Assured	21,835
<b>Lands Tentatively Suitable for Timber Production</b>	<b>504,615</b>
<b>Lands Not Appropriate for Timber Production</b>	
Lands where Management Area Prescriptions preclude Timber Production	4,605
Lands where management requirements (219.27) cannot be met	20,717
Lands not cost efficient in meeting Forest objectives, including timber production	139
<b>Lands Suitable for Timber Production</b>	<b>479,154</b>
<b>Lands Not-Suitable for Timber Production</b>	<b>1,062,920</b>

<sup>1</sup> - Includes forested lands that are not capable of producing industrial wood, such as pinyon-juniper woodlands.

<sup>2</sup> - The area displayed in this section is expected to vary by alternative in the Plan revision analysis.



## Rangeland Suitability

Procedures in the 1982 Planning Rule require that the suitability and capability for producing forage for grazing animals on National Forest System Lands be determined in forest planning. Suitability is the appropriateness of applying certain resource management practices to a particular area of land in consideration of the relevant social, economic, and ecological factors. Capability is the potential of an area of land to produce resources and supply goods and services. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology. Areas within the plan area are not suitable if livestock grazing would result in substantial and permanent impairment of the land or if the use is incompatible with the desired conditions.

Capability to produce forage for grazing animals was determined in the 1980s during the first round of forest planning. Most landscape scale conditions that determine capability have not changed significantly since the first evaluation. , however the data and the analysis tools used in the initial determination were are not as accurate or precise as what is available today. For the revised plan capability was reassessed across the Forest using the corporate GIS.

The analysis started with Gross Area of KNF (1,600,167), subtracted areas not administered by the FS (-57,762) and adjustments to the Plan area (-5,489) for net areas in the analysis area (1,543,819). The following “no-capability” acres were subtracted: slopes > 40% (-165,710), severe erosion hazard (-176,782), forage productivity < 100 #/ac/yr (-88,540). The remaining acres are considered generally capable for livestock grazing (1,107,298).

This area is about 12% less than the calculation in the original record. The determination of how lands designated as no-capability are managed is decided at the project level, following site-specific analysis.

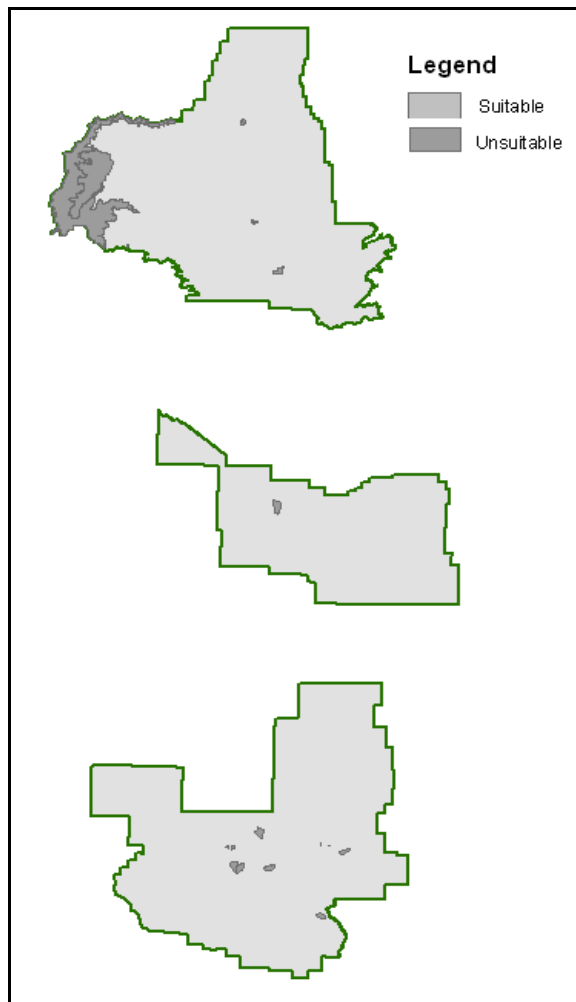
A “suitable” determination indicates that grazing is compatible with the desired condition for the relevant portion of the plan area. It is not a decision to authorize livestock grazing and does not mean that livestock grazing would occur over the entire area. The final decision to authorize livestock grazing is made at the project (allotment) level, where site specific conditions can be addressed.

The original Plan identifies four management areas as unsuitable for livestock grazing. They are displayed in Table 2. Two Existing Developed Recreation Sites (Moqui Lodge and Benham Snowplay Area, 202 and 17 acres, respectively) were subsequently closed. Desired conditions for these areas that are managed for their original purpose are likely to continue to be unsuitable for livestock grazing. The management areas for the two closed sites will cease to exist and would be returned to suitable for livestock grazing.

Since the original Plan was approved, each allotment on the KNF has received site-specific environmental review. The decisions for those analyses were reviewed for areas where livestock grazing was not authorized. On seven allotments, there were springs or lakes that were excluded from grazing in the site-specific decisions. Additionally, there were three large contiguous areas that were not authorized for grazing: the Kanab Creek allotment, the Jump up pasture of the Central Winter Allotment, and a portion of the Hat Allotment. These areas are large enough that they meet the Regional direction for a change in suitability determination. In the revised plan, the following areas are identified as not suitable for livestock grazing.

**Table 3. Grazing Suitability, Kaibab National Forest.**

Feature	Area	Note
Arizona Bugbane Botanic Area	618	Management Areas closed to grazing.
Garland Prairie Research Natural Area	401	
Franks Lake Geologic/Botanic Area	170	
Existing Developed Recreation Sites	3,986	
Kanab Creek Allotment	39,280	Closed to grazing in site-specific NEPA decision in March, 2001
Jump-up Pasture, Central Winter Allotment	15,745	Closed to grazing in site-specific NEPA decisions
Bill Williams Mtn., Hat Allotment	2,500	
<b>Total Unsuitable Area</b>	<b>62,700</b>	



**Figure 2– Suitable and unsuitable lands for livestock grazing.**

## Minerals and Energy Resources Suitability

The Forest Plan NEPA process can make suitable (or unsuitable) determinations for extraction or use of common variety minerals and energy (oil, gas geothermal) resources on the Forest. For locatable minerals, the process can only identify areas in support of recommend withdrawals (unsuitable); extra-Plan processes, including withdrawal decisions that are beyond agency authority are necessary for unsuitable designations to be effected. In all other cases, NF land is open to mineral entry.

Note: Locatable minerals are generally hardrock materials mined or processed for the recovery of metals and nonmetallic minerals and uncommon varieties such as distinctive deposits of limestone and silica.

Existing Forest Service policy calls for the Forest to:

- Encourage and facilitate the orderly exploration, development and production of mineral and energy resources on NFS lands to maintain a viable, healthy minerals industry.
- Ensure that exploration, development and production of mineral and energy resources are conducted in an environmentally sound manner and that these activities are integrated with the planning and management of other National Forest resources.

There are several potential changes in suitability to consider in the revised Forest Plan:

- It is clear that the potential for oil, gas or geothermal energy is low across the entire KNF.
- Some specific areas have become highlighted as Traditional Cultural Properties, important to tribes that use the KNF.
- Potential or actual extraction of uranium ore near the Grand Canyon NP has become politically charged, with a 20-year rescission being actively considered by USDI. If enacted, this could affect most of the NK RD and all of Tu RD.
- Solar and wind resources are being developed near the KNF and requests for development on the Forest have been received. Energy transmission is addressed in the current Plan and in the subsequent Western Energy Corridor EIS process. Solar and wind generation on the Forest may need to be addressed as well, perhaps as a suitability decision.

Demand for mineral materials is likely to continue. Displays the current status of minerals and energy resources suitability on the Forest. This is taken from text in the existing Forest Plan. There is map of minerals suitability for the current Plan.

Definitions of terms used in this column:

Withdrawn – Not open to mineral entry except for valid existing rights. Eg. “unsuitable”.

Withdraw – Proposed Plan supports pursuit of withdrawal from mineral entry. Eg. “unsuitable”.

Available – Open to entry (common variety or energy resources) if site-specific NEPA determines it is acceptable. Eg. “suitable”.

Unavailable – Not open to entry (common variety or energy resources.) Eg. “unsuitable”.

TBD – Temporary withdrawal from uranium mineral entry to be determined in an ongoing process.

**Table 4. Proposed Plan Minerals and Energy Resources Suitability.**

Location	Suitability <sup>2</sup>	Authority	Notes
Grand Canyon Game Preserve	Withdrawn	GCGP Act of 1906	Litigated in 1985. United States prevailed.
Kanab Creek Wilderness (NK RD)		No new claims could be filed after the passing of the Arizona Wilderness Act of 1984.	Also mostly within Grand Canyon Game Preserve
Kendrick Mountain Wilderness (Wi RD)			KNF Plan also contains direction for Coconino NF portion.
Saddle Mountain Wilderness (NK RD)			Also within Grand Canyon Game Preserve
Certain Administrative and electronic sites	Withdrawn		
Areas of acquired lands that FS has mineral rights to.	Unavailable		Determination regarding mineral rights will be made on a site specific basis in response to proposals.
LMAs with mineral material suitability	Available		
LMAs with mineral material unsuitability – plus Bill Williams Watershed]	Unavailable		
Oil, gas, geothermal	Unavailable		
Solar & wind	Unavailable		

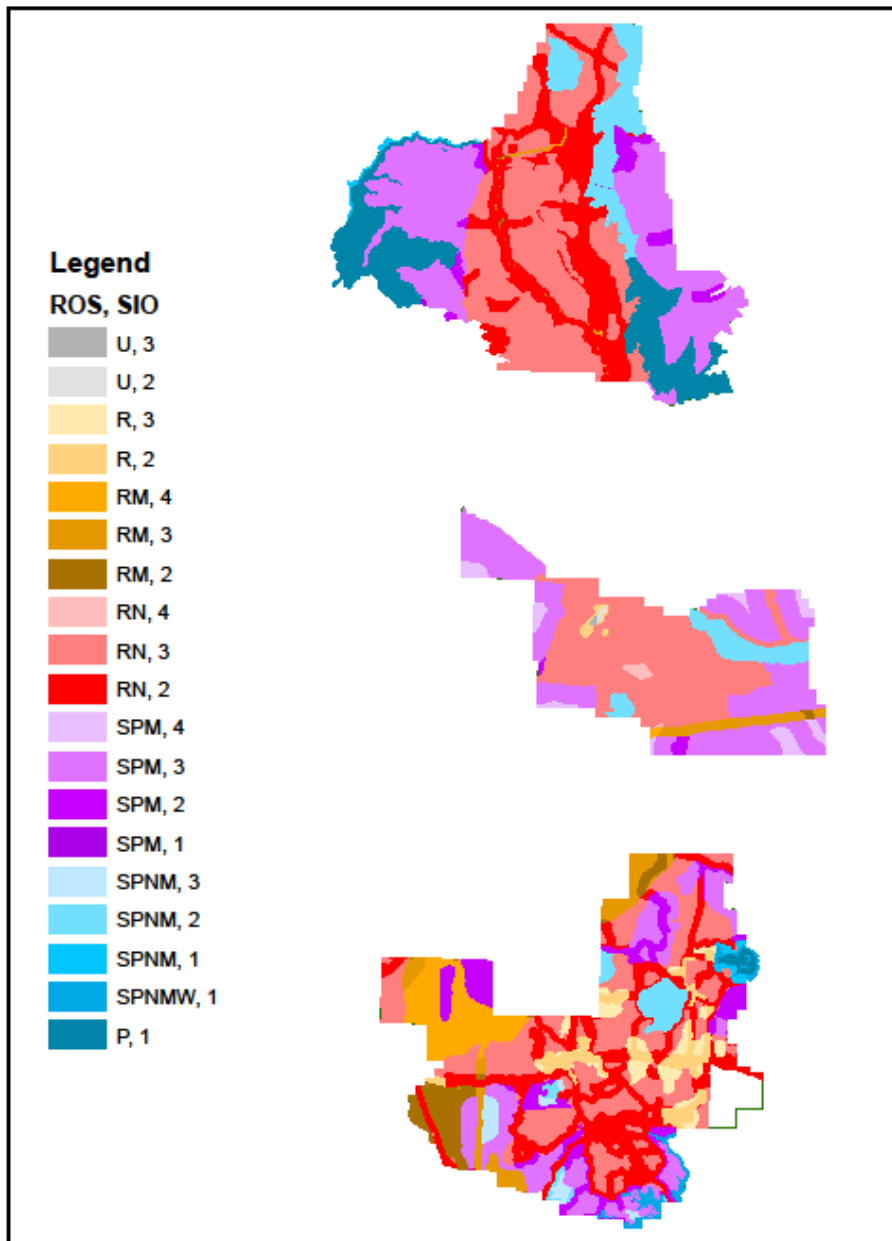
### **Recreation Suitability**

Management of forest landscapes employs the Recreation Opportunity Spectrum (ROS) and Scenery Management System Scenic Integrity Objectives (SIO) site specific mapping and management displayed below as well as management guidance.

ROS is based on the premise that visitors choose specific settings for their recreation activities in order to enjoy the desired experiences. Using a classification system, seven potential classes of recreation opportunity are applied. Each class describes different outdoor recreation settings and characteristics such as size, scenic quality, type and degree of access, remoteness, level of development, social encounters, and amount of on-site management. The classes include primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, roaded modified, rural and urban. By describing the existing recreation opportunities in each class, ROS helps visitors match with their preferred recreation setting.

The Scenery Management System was developed by the Forest Service to provide a vocabulary and systematic approach for managing scenery in national forests. It integrates the biological, physical and cultural elements that combine to make each landscape unique. The process involves identifying scenery components as they relate to people, mapping the components and developing a value for aesthetics from the data gathered. Most recreation oriented people who visit national forests have an image of what they expect to see. Application of the mapping is based upon the assumption that people value most highly the more visually attractive and naturally appearing landscapes. Scenic integrity is used to describe the degree of intactness of the scenery and the levels include very high, high, moderate, low and very low. Scenic integrity can also be used to describe past, present and future landscapes.

The ROS classes and SIO levels displayed in the suitability maps indicate the desired conditions for the landscape. The existing ROS and SIO may not currently meet these desired conditions, but projects must maintain or improve these in order to meet the desired conditions.



**Figure 3. Recreation and Scenic Integrity.** Refer to the Glossary (Recreation Opportunity Setting and Scenic Integrity Objectives) for an explanation of codes.

### Suitability for Motorized Use

The areas identified as unsuitable for motorized use identified in the current plan will be brought forward into the proposed revised plan (reference current visitor map). Site specific determinations for designated roads and trails are made in the travel management planning process. Areas suitable for motorized use will be displayed on a motor vehicle use map (MVUM).

## Chapter 5: Monitoring and Adaptive Management

### Monitoring Plan

Monitoring and the subsequent evaluation of results provide the platform through which adaptive management is enabled. It is the feedback mechanism through which management actions may be modified. For feedback to be successful, effective monitoring must encompass data collection, interpretation and analyses and availability. Despite advances in ecological, social, political, and economic understanding of forest issues, landscape scale ecological restoration involves operation under considerable uncertainty. The primary strategy for dealing with this uncertainty is adaptive management, or “learning by doing”. Adaptive management (AM) is an integrated approach for coping with the uncertainties inherent in predicting how ecosystems will respond to human interventions. AM combines planning, implementing, monitoring, research, evaluating, and incorporating new knowledge into management approaches based on scientific findings and the needs of society. AM involves carefully observing ecological and human systems’ responses to management actions, and adjusting future actions based on what was learned. AM responds realistically to ignorance about the ecosystem by monitoring the results of management efforts in order to make adjustments as needed. Monitoring is the backbone of AM. In order to be effective, monitoring should detect change of a certain magnitude. Monitoring must be focused, driven by specific questions and objectives and should be realistic in terms of budgetary limitations.

Monitoring is needed to support adaptive management, with a focus on outcomes and progress toward desired conditions. Adaptive management allows for regular adjustments needed to achieve and maintain desired conditions. It includes defining measurable objectives, monitoring, learning, making changes, and recognizing uncertainties of outcomes.

Monitoring and evaluation document and report how well the plan is being implemented, how well it is working, and if direction is still appropriate by determining actual conditions and circumstances and comparing them with assumptions and desired results. Evaluation examines conditions as a result of management, identifies possible reasons desired conditions are not met and proposes alternative solutions. Monitoring and evaluation are fundamental to a good management program and:

- Provide data on program progress and effectiveness
- Improve program management and decision-making
- Allow accountability to stakeholders
- Provide data to identify future resource needs
- Provide data useful for policy-making and advocacy
- Provide data to inform follow up research questions

The monitoring program includes the monitoring questions and corresponding performance measures listed in the following section. Monitoring questions focus on key plan components

where carrying out projects and activities is likely to cause a change over time. The adaptive management cycle also includes an approach for responding to changing conditions or public desires and to new information, including research and scientific papers.

### **Monitoring Framework**

#### **Monitoring Guidelines and Components**

Monitoring should 1) meet legal requirements, 2) be consistent with corporate data standards and protocols, and 3) be developed by an interdisciplinary team that addresses the ecological, social and economic dimensions of forest management in an integrated manner. To meet these objectives, the Kaibab National Forest's monitoring framework has four components:

- 1) Forest Plan (Chapter 5) Direction that provides broad, strategic guidance. Provides the monitoring requirements in the forest plan itself. It focuses on what is needed to monitor the forest plan. It provides the overall monitoring strategy including specific questions that need to be answered, what will be monitored, timetables for reporting, and other information.
- 2) A Monitoring and Evaluation Implementation Guide that provides specific, technical guidance. Describes how, where, and when to accomplish the monitoring prescribed in the forest plan. It provides the specific methods, protocols and analytical procedures. The Guide is intended to be flexible and could be modified in response to new information, updated procedures, emerging issues, and budgetary considerations without amending the forest plan.
- 3) An Annual Monitoring Schedule that outlines specific tasks for the current year
- 4) An Annual Monitoring Evaluation Review that provides a forum to review current year findings and identify specific modifications if necessary.

#### *Monitoring Goals*

- Determine the status and trends in selected indicators of the condition of the Kaibab National Forest to allow managers to make better-informed decisions and to work more effectively with other agencies and individuals for the benefit of forest lands.
- Provide early warning of uncharacteristic conditions for selected resources to help ameliorate such conditions, develop effective and early preventative measures, and reduce management costs.
- Provide data to better understand the dynamic nature and condition of Kaibab National Forest lands and to provide reference points for comparisons of forest change over time.
- Provide data to meet certain legal and Congressional mandates related to the National Forest Management Act, multiple land use policy etc...
- Provide a means of measuring progress towards performance goals and desired conditions at multiple spatial and temporal scales.

This plan is adaptive in nature and primarily focuses on effectiveness and implementation monitoring. It seeks to answer the general questions; "Did the Forest do what it said it was going to do?" and "Have those actions been effective at achieving desired conditions?"



Validation monitoring is research level monitoring which typically requires extensive field experiments and adheres to strict experimental design. It examines key assumptions associated with conservation actions, typically focused on cause-and-effect relationships. This type of monitoring is time and labor intensive, expensive and beyond the scope of the forest monitoring plan. However, data collected as a result of forest plan effectiveness and implementation monitoring should allow the Forest to identify appropriate follow up research questions that may be answered by other interested stakeholders through this type of validation monitoring. Collaboration of this nature is encouraged and will allow the Kaibab NF and its stakeholders to develop a better understanding about the surrounding landscape. Further, it should promote mutually beneficial relationships leading to better informed management over time, for example the effectiveness of implementing the fine scale desired conditions in retaining snowpack which is likely to become more important in the face of climate change.

### **Monitoring Matrix**

The Monitoring Matrix is a table outlining a general framework for achieving forest plan monitoring objectives (Table X). It is strategic in nature and addresses specific questions which address how effectively the KNF is moving towards achieving its desired conditions and land planning objectives within a given resource area. It does not address project level compliance monitoring (unless it answers a forest-wide question), or monitoring already covered under existing law, regulation, and policy (e.g. monitoring already required under a species specific recovery plan).

Compliance monitoring addresses questions about adherence to standards and guidelines, e.g. are forest treatment areas surveyed for invasive species pre and post implementation? Suggested compliance monitoring to be completed by projects will be addressed in the implementation Guide. The type of project level monitoring this matrix does provide for will incorporate a sample design strategy that is systematic, rapid and used by various resource areas. When aggregated across the forest, plots assessed through this type of project level monitoring will help to answer questions about desired conditions at the forest plan level. This framework should also provide other interested stakeholders the opportunity to use these same plots, providing a platform through which to answer a broad variety of monitoring questions in an integrative fashion over time.

A more prescriptive implementation plan will be addressed in the Monitoring Guide (to be developed). This implementation plan will discuss “the how” in terms of specific sample designs and strategies, identify indicator variables and models to be used, and target thresholds/benchmarks to be met. The implementation guide is not a plan component and as such, will allow it to be more responsive and adaptive with regard to emerging issues in science, improvements in better survey methodology/techniques and fluctuations in budget. This guide will be developed collaboratively with area experts and statisticians so that it yields statistically valid, robust and contemporary data sets.

The focal point for each monitoring item in the Monitoring Matrix will be the Monitoring Question. Each Monitoring Question is derived from one or more Monitoring Drivers (e.g., Legal Requirements, Desired Conditions or Objectives etc...). Definitions are outlined below. Not all monitoring drivers will be monitored each year. Drivers that best answer the monitoring question for each resource area will be identified annually through the annual monitoring schedule.

## Monitoring Matrix Definitions

**Monitoring Question:** Specific monitoring question(s) developed to ensure that monitoring and evaluation addresses information essential to measuring progress towards meeting the Forest Plan objectives and Desired Conditions. These questions relate to the different purposes and rationales for monitoring. There may be more than one monitoring question per resource area.

**Monitoring Driver:** Monitoring drivers identifies the reason or why we are monitoring a particular monitoring item. Drivers can be (1) Legal and regulatory requirements and Forest Service Manual direction (2) Forest Plan desired conditions, goals, objectives standards and guidelines (3) Validation of assumptions and predictions, (4) Court rulings or legal and regulatory compliance.

**Resource Area:** A quantitative or qualitative parameter that can be assessed. For example vegetation communities, fish and wildlife species, invasive species etc...

**Key Ecological Attributes:** An attribute for which alteration beyond some critical range/threshold will lead to loss of the resource in short period of time. Examples include changes in structure, composition, pattern and process.

**Indicator:** A metric used to assess key ecological attributes for a resource area. Should be specific and measurable, can include multiple metrics, although one metric can potentially answer several different questions. These attribute measurements can be quantitative and/or qualitative and should provide enough information to answer the monitoring question(s) while being the most cost efficient. Indicators should be those that can be effectively and systematically monitored in a repeatable fashion using existing survey methodology and within budgetary constraints. This plan identifies three primary indicators:

- *Remote:* Indicate status of key ecological attributes for a focal ecological resource at landscape scales and/or at coarser spatial resolution. Data sources include GIS and remote sensing imagery which would answer changes in land cover across an entire forest. Examples include things such as landscape composition, pattern, and fragmentation.
- *Rapid:* Indicate status of key ecological attributes for a focal ecological resource at the mid to fine spatial scales although measurements in multiple locations can still provide wide spatial coverage. Data sources might include relatively simple field based metrics as well as remote sensing data. Examples include qualitative vegetation structure, plant species dominance, community composition of certain wildlife taxa, and qualitative assessments of riparian areas.
- *Intensive:* Indicate status of key ecological attributes for a focal ecological resource at fine spatial scales or spatial resolution although measurements in multiple locations can still provide wide spatial coverage. Data sources might include simple to complex field based metrics, usually quantitative and collected within a statistical sampling design. Examples include surveys of birds to assess density levels, analyses involving specific soil and water chemistry parameters, quantitative vegetation structure.

**Measurement Frequency:** Describes how often monitoring information is collected. This will vary based on resource area, monitoring driver, and question.

**Evaluation and Reporting Frequency:** Describes how often monitoring information is evaluated and reported on. Data will be assessed after 2 years to establish a “baseline” through which to compare change. A comprehensive review will be conducted after 5 years of monitoring and then ever 5 years thereafter. This will allow the Forest to carefully scrutinize the overall monitoring program, as well as management actions and to identify if any thresholds have been exceeded which could trigger a change in management or at the very least further investigation.

<i>Resource Area</i>	<i>Key Ecological Attributes</i>	<i>Monitoring Question (s)</i>	<i>Driver (applicable policy, desired conditions, objectives etc..)</i>	<i>Measurement Frequency</i>	<i>Data Source /Indicators (Remote<sup>1</sup> Rapid<sup>2</sup> Intensive<sup>3</sup>)</i>	<i>Evaluation/ Reporting Frequency</i>
<b>Major Vegetation Community Types</b>  <b>Ponderosa Pine and Frequent Fire Mixed Conifer</b>	Forest Structure	What percentage of the forest is in the desired condition at a scale above 100 acres?	<b>Landscape DC:</b> The ponderosa pine forest vegetation community is a mosaic of forest conditions composed of structural stages ranging from young to old trees. The forest is generally uneven-aged and open •Older natural vegetation stages and associated “old growth” components (declining trees, snags, downed logs, and old trees) are well distributed in the landscape.	3-5 years	VDDT states <sup>1</sup> BA <sup>1</sup>	3-5 years
			<b>Midscale DC:</b> The ponderosa pine forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages present.			
			<b>Midscale DC:</b> Forest conditions in some areas contain 10 to 20 % higher basal area in mid-aged to old tree groups than in the general forest (e.g. goshawk post-fledging family areas, Mexican spotted owl protected areas, drainages, and steep north facing slopes).  <b>Other:</b> MSO recovery plan, Northern goshawk guidelines			

<b>Major Vegetation Community Types</b>  <b>Ponderosa Pine and Frequent Fire Mixed Conifer</b>	Forest structure	Are snags, coarse woody debris, and downed logs available at the desired levels?  Downed logs (greater than 12 inches diameter at mid-point, and greater than 8 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris greater than 3 inches in diameter (including downed logs), ranges from 3 to 10 tons per acre.	<b>Midscale DC:</b> Snags 18 inches DBH or greater average 1 to 2 snags per acre. Snags and green snags of variable size and form are common.	1-5 years	Snag Surveys <sup>2</sup>	1-5 years
<b>Major Vegetation Community Types</b>  <b>Ponderosa Pine and Frequent Fire Mixed Conifer</b>	Composition (understory plant productivity and abundance)	Is Stand Density index within a range that will allow for a robust understory?  What % or area is within the desired range for Basal area? Openings?	<b>Midscale DC:</b> The more biologically productive sites contain more trees per group and more groups per area. Basal area within forested areas generally ranges from 20 to 80 sqft <sup>2</sup> /acre. Openings with grass/forb/shrub vegetation are variably-shaped and occupy 10% in the more productive types and 70% in less productive sites.		SDI <sup>12</sup>  BA <sup>12</sup>  Canopy <sup>1</sup>	1-5 years
<b>Major Vegetation Community Types (fire adapted ecosystems)</b>  <b>Ponderosa Pine</b>	Pattern	Is fire occurring at a frequency that approaches or meets the historic fire regime?  What % and number of acres burned reflect the desired condition for fire behavior and effects?	<b>Finescale DC:</b> Fires generally burn as surface fires, but single tree torching and isolated group torching is not uncommon. <b>Midscale DC:</b> Fires primarily burn on the forest floor and typically do not spread between tree groups as crown fire. <b>Landscape DC:</b> Fire and other disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris loads, and nutrient cycling. Frequent, low severity fires (Fire Regime I) occur across the entire landscape with a return interval of 0 to 35 years.	Annually	FACTS <sup>12</sup>  RAVG <sup>12</sup> Percent or number of acres burned	5-10 years, running average

<b>Major Vegetation Community Types (fire adapted ecosystems)</b>  <b>Ponderosa Pine and frequent fire Mixed conifer</b>	Pattern	<p>What is the % or area of contiguous acres (above the midscale) at risk for active crown fire.</p> <p>Is there a change in condition in treated areas?</p>	<p><b>Obj (pine):</b> To reduce the potential for active crown fire in ponderosa pine communities:</p> <ul style="list-style-type: none"> <li>• Mechanically Thin 11,000 to 19,000 acres annually.</li> <li>• Burn an average of 13,000 to 55,000 acres annually using a combination of prescribed fire and naturally ignited wildfires.</li> </ul> <p><b>Obj (conifer):</b> Burn an average of 1,000 to 13,000 acres annually using prescribed fire and/or naturally ignited wildfires.</p> <p>Mechanically thin 18,000 to 32,000 acres over the plan period.</p>	Annually	<p>RAVG<sup>12</sup> FLAMAP<sup>1</sup> Percent or number of acres burned</p> <p>Monitoring toolbox</p>	5-10 years, running average
<b>Major Vegetation Community Ponderosa Pine, Mixed conifer, spruce fir, and pinyon-juniper communities.</b>	Process	<p>What is the frequency, extent, location, and severity of insect and disease outbreaks?</p> <p>How does it compare to HRV?</p> <p>How many acres are at risk(above threshold SDI, varies by insect)?</p>	<p><b>Ponderosa Pine Landscape DC:</b> The landscape is a functioning ecosystem that contains all its components, processes, and conditions associated with endemic levels of disturbances (e.g. fire, dwarf mistletoe, insects, diseases, lightning, drought, and wind)/</p> <p>Forest vegetation conditions are resilient to the frequency, extent, and severity of disturbances and climate variability.</p>	Annually	<p>FHP aerial over flight data<sup>1</sup> acres affected, canopy cover.</p> <p>Stand Density Index</p>	1-5 years
<b>Major Vegetation Community Types</b>  <b>Aspen (Tusayan and Williams)</b>	Composition	<p>What was the total area treated in aspen?</p> <p>Is aspen regenerating and becoming established in treated areas?</p>	<p><b>Aspen Obj :</b> Fence 200 acres of aspen within 10 years of plan approval, Reduce conifer encroachment on 800 acres of aspen within 10 years of plan approval.</p>	1-5 years	INFRA Aspen Stand survey <sup>3</sup>	1-5 years

<b>Major Vegetation Community Types</b>  <b>Aspen (forestwide)</b>	Composition	What is the status and trend in the areal extent and configuration of aspen on all KNF lands?	<b>Aspen DC:</b> Aspen is successfully regenerating and recruiting into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smallest classes, Where aspen is present; it is stable or increasing in ponderosa pine and dry mixed conifer forests.	3-5 years	Aspen Stand survey w/ time lapse photos on the SZ <sup>13</sup>  FIA on NKRD	3-5 years
<b>Major Vegetation Community Types</b>  <b>Natural Waters</b>	Composition and Process	In restored areas, are water flow patterns and vegetation intact and resilient to disturbance events?  Are desired wildlife and plant species present, what is the trend?	<b>Natural Waters DC:</b> Stream channel stability and aquatic habitats retain their inherent resilience to natural and other disturbances. Stream channel morphology reflects changes in the hydrological balance, runoff and sediment supply appropriate to the landscape setting.  Springs and ponds have the necessary soil, water, and vegetation attributes to be healthy and functioning. Water flow patterns, groundwater recharge rates, and geochemistry are similar to historic levels.  Within its capability, stream flow and water quality is adequate to maintain aquatic habitat and water sources for native and selected non-native wildlife.	1-10 years	Forestwide riparian surveys/ Frequency Surveys, Museum of Northern AZ <sup>2</sup>  Orthoquads <sup>1</sup>  PFC for wetlands, other metrics for seeps and springs-MNA level 2 monitoring <sup>3</sup> .	1-10 years
<b>Major Vegetation Community Types</b>  <b>Natural Waters</b>	Composition and Process	Are fence exclosures intact and providing intended benefits for wildlife and plant species?  What is the status and trend in the areal extent of natural waters on the KNF?	<b>Natural Waters Obj:</b> Protect and/or restore at least 10 individual springs within 5 years of plan approval.  Maintain, or increase, the existing acreage of wetlands on the Forest over the life of the Plan.	1-10 years	INFRA Orthoquads <sup>1</sup>  PFC for wetlands, other metrics for seeps and springs-MNA level 2 monitoring <sup>3</sup> .	1-10 years

<b>Major Vegetation Community Types</b>  <b>Grasslands</b>	Composition and Pattern	<p>what is the trend in % of vegetative cover?</p> <p>What is the fire return interval? Is it within its historic range?</p> <p>What % of the PNVT has &lt;10% canopy cover and what is the change over time?</p>	<p><b>DCs:</b> Vegetation is composed of a mix of native grasses and forbs. The structure, composition, and distribution of vegetation are within the range of natural variability and occur in natural patterns of abundance.</p> <p>Vegetation height and cover are sufficient to support the historic fire return interval.</p> <p>Grass/forb/shrub canopy cover is typically above 25%, with less than one quarter of any grassland below this range.</p> <p>Tree canopy cover ranges from 0% to 9%, depending upon specific site conditions</p>	1-5 years	<p>FSVeg, FACTS, GIS,</p> <p>Remote sensing with Landsat</p> <p>Rapid Plots</p>	1-5 years
<b>Major Vegetation Community Types</b>  <b>Grasslands</b>	Connectivity	Are fences “pronghorn friendly” promoting the safe movement of pronghorn across the forest?	<p><b>Grass lands Obj:</b> Modify fences and/or install pronghorn crossings on 50 miles of fence within 10 years plan approval.</p>	1-5 years	INFRA	1-5 years
<b>Major Vegetation Community Types</b> <b>(PJ, Grasslands)</b>	Connectivity and Pattern	Are wide ranging ungulates (e.g. pronghorn) effectively moving across the landscape?	<p><b>PJ, Grassland DCs:</b> There is connectivity of openings between trees that provide for sufficient sighting distance and facilitate pronghorn movement</p>	1-5 years	AZGFD, Forest level winter snow tracking survey	1-5 years



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<b>Major Vegetation Community Types (PJ)</b> [crosswalk with heritage]		Is pinyon mast stable and producing seed? (could also monitor climate change-as pinyon is very sensitive to drought)	<b>PJ DC:</b> A robust crop of pinyon pine nuts are regularly produced.	1-5 years	TBD, free pinyon permits that would include a mail in survey of how much was collected? Document Bumper years.	1-5 years
<b>Rare and Narrow Endemic Species</b>		What is the trend in habitat for select narrow and endemic species? Is management effectively protecting narrow and endemic species during project implementation?	<b>Narrow endemic DCs:</b> There is habitat and refugia for narrow endemics or species with restricted distributions and/or declining populations, location and conditions of rare and narrow endemic species are known.	TBD	TBD, Spring monitoring	TBD
<b>Invasive Species</b>		What is the areal extent, distribution and abundance of selected non-native invasive plants on the KNF?	<b>Invasive species DC:</b> New populations are detected early, monitored, and treated as soon as possible. <b>Invasive Obj:</b> Treat 2,000 to 3000 invaded acres annually.	Every 2 years	Frequency surveys, NPS weed survey protocol (NK), visit all thinning and burning projects	Every 2 years
<b>Invasive Species</b>		Are non-native fauna adversely affecting native species or processes?			Bullfrog and crayfish surveys,	
<b>Wildlife and Fish (T&amp;E,R3 sensitive species, SGCN-GF)</b>		How are the ecological conditions for select species of interest maintaining or making progress toward FP desired conditions and objectives?	<b>Wildlife DC:</b> Habitat for species with specific tree habitat needs such as snags, logs, large trees, interlocking canopy, and cavities is provided. Grass, forb, and shrubs provide adequate forage, cover, fawning, and nesting sites. Interconnected habitats allow for movement of wide-ranging species and promote natural predator-prey relationships, while minimizing human-wildlife conflicts. <b>MSO recovery plan</b>	TBD	Snag surveys, Remote sensing data (connectivity patch size, canopy cover), monitoring toolbox NAU.	TBD

<b>Wildlife and Fish (Bird-habitat relationships)</b>		<p>What effects do forest management actions have on breeding bird populations?</p> <p>How have forest treatments affected forest bird species composition and abundance with changes in specific habitat variables?</p>	<p><b>Policy:</b> Migratory Bird Treaty Act, FWS MOU</p> <p><b>Wildlife DC:</b> Habitat is available at the appropriate spatial, temporal, compositional, and structural levels such that it provides adequate opportunity for breeding, feeding, nesting, and carrying out other critical life cycle needs for a variety of vertebrate and invertebrate species. Habitat for species with specific tree habitat needs such as snags, logs, large trees, interlocking canopy, and cavities is provided. Grass, forb, and shrubs provide adequate forage, cover, fawning, and nesting sites. Interconnected habitats allow for movement of wide-ranging species and promote natural predator-prey relationships, while minimizing human-wildlife conflicts.</p>	TBD	RMBO Surveys Data Toolbox- NAU	TBD
<b>Wildlife and Fish (MIS)</b>		What are the population trends of management indicator species?	<p><b>FSM Policy:</b> Population trends of the management indicator species will be monitored and relationships to habitat changes determined. This monitoring will be done in cooperation with state fish and wildlife agencies, to the extent practicable.</p>	5-10 years	RMBO/NRIS Wildlife  AGFD	5-10 years
<b>Wildlife &amp; Fish (Snags)</b>		Are snags adequately distributed across the forest and provide habitat for wildlife?	<p><b>Wildlife DC:</b> Habitat is available at the appropriate spatial, temporal, compositional, and structural levels such that it provides adequate opportunity for breeding, feeding, nesting, and carrying out other critical life cycle needs for a variety of vertebrate and invertebrate species. Habitat for species with specific tree habitat needs such as snags, logs, large trees, interlocking canopy, and cavities is provided</p>	TBD	Snag surveys, or RMBO counts	TBD

<b>Soils and Watersheds</b>		Is the water quality of KNF lakes within the seasonal range of variable conditions including temperature, dissolved oxygen, and water levels?	<b>Watershed Dc:</b> Water quality meets or exceeds State of Arizona or Environmental Protection Agency water quality standards for designated uses. Water quality meets critical needs of aquatic species.	1-5 years	ADEQ/NOAA data	1-5 years
<b>Soils and Watersheds</b>		Are the effects of forest management resulting in significant changes to the productivity of the land?	<b>Soil Dc:</b> Soil function and inherent long-term productivity are sustained so that the soil can resist erosion, recycle nutrients, and absorb water.	TBD	TES	TBD
		Soil loss is below tolerance.	<b>Soil Dc:</b> Soil function and inherent long-term productivity are sustained so that the soil can resist erosion, recycle nutrients, and absorb water.			
		Restoration and reclamation of surface disturbance associated with mining operations should be implemented to achieve 70% of ground cover (as compared to nearby undisturbed areas) with permanent native vegetation within 3 growing seasons.	<b>Soil Dc:</b> Vegetative ground cover is well-distributed across the soil surface to promote nutrient cycling and water infiltration.			
		Restoration and reclamation of surface disturbance (skid trails, landings, temporary roads) associated with vegetation management activities should be implemented to achieve 80% of effective ground cover within 3 growing seasons.	<b>Soil Dc:</b> Vegetative ground cover is well-distributed across the soil surface to promote nutrient cycling and water infiltration.			

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<b>Biogeologic</b>						
<b>Cultural Resources</b>		Are cultural resources being protected in place?	Preservation of cultural resources.	ongoing	Cultural resources database	ongoing
<b>Air Quality</b>			Air Quality DC: Air quality above the Kaibab National Forest meets State air quality standards for visibility and public health.	annually	ADEQ	annually
<b>Recreation</b>		Is the forest providing adequate recreational opportunities for the public while maintaining sustainable resources?	<b>Recreation DC:</b> The forest provides a range of recreation settings and corresponding high quality scenery for the public to engage in developed and dispersed recreation activities in concert with other resource management and protection needs. Recreation opportunities are balanced with the ability of the land to support them. Minimal user conflicts.	annually (20 % of each ROS each year)	Recreation/Visitor use monitoring through free surveys	annually
<b>Special Uses</b>						

<b>Minerals</b>		Are mineral exploration, development and production avoidance or mitigation measure effective and being followed as recommended in project designs?	<b>Mineral s Dc:</b> Minerals and energy developments meet legal mandates to facilitate production of mineral and energy resources on the Forest in a manner that minimizes adverse impacts to surface and groundwater resources, and that do not detract from meeting other desired conditions applicable to the area. Important wildlife habitats, visually sensitive areas, habitats of threatened and endangered plants and animals, American Indian sacred sites and areas with large capital investments are protected through project design to achieve and maintain the desired conditions for the area.	1-5 years	TBD	1-5 years
<b>Tribal Traditional and Cultural Uses</b>		Is pinyon mast stable and producing seed? [crosswalk with Veg communities/PJ] (could also monitor for climate change-as pinyon is very sensitive to drought)	<b>Tribal Traditional and Cultural Use DC:</b> Traditional tribal uses, such as the collection of medicinal plants, wild plant foods, basketry materials, and ceremonial Fuelwood are recognized as important uses and are supported by the Forest. Traditionally used resources are not depleted and are available for future generations.	1-5 years	Mail in survey of how much was collected?	1-5 years
<b>Tribal Traditional and Cultural Uses</b>		What is the status and trend of select plant species of medicinal and cultural value as a result of prescribed and managed fires	<b>Tribal Traditional and Cultural Use DC:</b> Traditional tribal uses, such as the collection of medicinal plants, wild plant foods, basketry materials, and fuel wood, are recognized as important uses and are supported by the Forest.  Traditionally used resources are not depleted and are available for future generations.	1-2	Local knowledge/tribes	1-5

<b>Livestock Grazing</b>		Are livestock numbers balanced with forage capacity?	<b>Livestock grazing DC:</b> Grasses and forbs provide adequate forage for permitted livestock consistent with other desired conditions.	1-5 years	Parker/Frequency surveys, monitor AUMs	1-5 years
<b>Forestry and Forest Products</b>		To what extent is forest management occurring on lands suitable for production?	<b>Forestry and Forest Products DC :</b> A sustained level of timber outputs is available from suitable timberland in an economically efficient manner to support local dependent industries and support local communities. A sustainable wood harvesting and utilization industry exists of a size and diversity required to effectively and efficiently restore the ponderosa pine vegetation community.	TBD	TBD	TBD
<b>Transportation and Forest Access</b>		To what extent is the forest providing safe, cost effective, minimum necessary road systems for administrative and recreational use?	<b>Transportation DC:</b> Forest roads and trails provide legal and reasonable access for recreation opportunities and resource management.	TBD	TBD	TBD
<b>Lands</b>			<b>Lands Obj:</b> Public access for all permanent roads and trails within the National Forest boundary is obtained within 10 years of plan approval.			
<b>Climate Change</b>		Are climatic variables compatible with forest restoration objectives?				
<b>Climate Change</b>		Are climatic variables compatible with maintaining healthy wildlife populations?	<b>Wildlife DC:</b> Habitat configuration and availability allows wildlife populations to adjust their movements (e.g. seasonal migration, foraging etc.) in response to climate change and promote genetic flow between wildlife populations.			

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<b>Arizona Bugbane Botanical Area</b>		Does current management support viable populations of AZ Bugbane?	<p><b>DC for Bugbane Botanic Area:</b> Arizona Bugbane has a sustainable population and is at low risk for extirpation. The character of this area is maintained. <b>OBJ:</b> Annually inspect the recreation trails and maintain as needed to manage hiking use. Annually inspect fences and maintain as needed for exclusion of livestock.</p> <p><b>Other:</b> Arizona Bugbane Conservation Agreement</p>	annually		annually
<b>Double A Wild Free-Roaming Horse and Burro Territory</b>		Are wild burro numbers within the desired range of 22-35 animals and is the number compatible with maintaining sustainability of the greater landscape?	<p><b>DC for Wild and free roaming burro territory:</b> A biologically sound burro population is in balance with native wildlife, permitted livestock, and other resource values.</p> <p>The burro herd ranges from 22 to 35 animals.</p> <p><b>Other:</b> Wild Free-Roaming Horses and Burros Act of 1971: Forest Service Handbook sections 2263.1 Territory Plans and 2265.3 - Removal of Excess Animals.</p>	annually	Parker Surveys/Frequency surveys for veg. Burro counts.	annually
<b>Wildland Urban Interface Areas</b>		Are low intensity fires adequately managed in the WUI and are they providing for healthy wildlife, human and ecosystem interactions?	<p><b>Wildland Urban Interface DC:</b> Wildland fires in the Wildland-Urban Interface (WUI) are low intensity surface fires, allowing for direct attack. Wildland fires in the WUI do not result in the loss of life, property or ecosystem function.</p>	TBD	BAER analysis (Fire Severity map), FACTS, GIS layers	TBD
<b>Pediocactus Conservation Area</b>		Are known populations and distributions of Pediocactus stable? Is current management responsive to the needs of this species?	<p>Paradine Plains Cactus Conservation Assessment and Strategy—Refer to Level 1 and Level 2 monitoring. Also think about before and after treatment effects.</p>	1-5 years	TBD	1-5 years

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<b>Buffalo Ranch</b>		Are buffalo herd post-hunt population numbers below the threshold specified in the current MOU/AMP?	MOU with Arizona Game and Fish, AMP	annually	AZ game and fish hunt and monitoring data, NPS monitoring data	annually
<b>Buffalo Ranch</b>		Is the Buffalo Ranch fence intact and effectively controlling animal movement?	MOU with Arizona Game and Fish	annually	AZ game and fish hunt and monitoring data, NPS monitoring data, INFRA	annually



## Glossary

**Age-class** is defined as trees that originated within a relatively distinct range of years. Typically the range of years is considered to fall within 20 % of the average natural maturity (e.g. if 100 years is required to reach maturity, then there would be five 20-year age classes).

**Basal area** is the cross-sectional area at breast height (4.5 ft above the ground) of trees measured in square feet. Basal area is a way to measure how much of a site is occupied by trees. The cross-sectional area is determined by calculating the tree's radius from its diameter ( $\text{diameter}/2 = \text{radius}$ ) and using the formula for the area of a circle ( $\pi \times \text{radius}^2 = \text{cross-sectional area}$ ). Basal area per acre is the summation of the cross-sectional area of all trees in an acre or in a smaller plot used to estimate basal area per acre. Diameter at root collar (defined below) is used to calculate the cross-sectional area of multi-stemmed trees such as juniper and oak.

**Browse** is either (1) The part of shrubs, half shrubs, woody vines, and trees available for animal consumption; or (2) to search for or consume browse. Interagency Technical Reference 1734-4 Sampling Vegetation Attributes. 1999 (ITR 1734-4)

**Clump** refers to a tight cluster of two to five trees of similar age and size originating from a common rooting zone that typically lean away from each other when mature. A clump is relatively isolated from other clumps or trees within a group of trees, but a stand-alone clump of trees can function as a tree group.

**Coarse woody debris** is woody material on the ground greater than three inches in diameter, including logs.

**Corridor:** A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries.

**Critical area** is an area which should be treated with special consideration because of inherent site factors, size, location, condition, values or significant potential conflicts among uses.

**Declining** refers to the senescent (aging) period in the lifespan of plants that (for trees) includes the presence of large dead and/or dying limbs, snag-tops, large, old lightning scars and other characteristics that indicate the later life-stages of vegetation.

**Diameter at breast height** (dbh) is the diameter of a tree typically measured at 4.5 feet above ground level.

**Diameter at root collar** (drc) is the diameter typically measured at the root collar or at the natural ground line, whichever is higher, outside the bark. For a multi-stemmed tree, DRC is calculated from the diameter measurements of all qualifying stems ( $\geq 1.5$ " diameter and at least one foot in length).

**Diversity:** The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

**Even-aged** forests are forests that are comprised of one or two distinct age classes of trees.

**Even-aged management** is the application of a combination of actions that results in the creation of stands in which trees of essentially the same age grow together. Managed even-aged forests are characterized by a distribution of stands of varying ages (and, therefore, tree sizes) throughout the forest area. The difference in age between trees forming the main canopy level of a stand usually does not exceed 20 % of the age of the stand at harvest rotation age. Regeneration in a particular

stand is obtained during a short period at or near the time that a stand has reached the desired age or size for regeneration and is harvested. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

**Fire regime** refers to the patterns of fire that occur over a long period of time across a landscape vegetation community and its immediate effects on the ecosystem in which it occurs. There are five fire regimes which are classified based on frequency (average number of years between fires) and severity (amount of replacement on the dominant overstory vegetation) of the fire. These five regimes are:

**Fire regime I** – 0 to 35 year frequency and low (surface fires most common, isolated torching can occur) to mixed severity (less than 75 % of dominant overstory vegetation replaced);

**Fire regime II** – 0 to 35 year frequency and high severity (greater than 75 % of dominant overstory vegetation replaced);

**Fire regime III** – 35 to 100+ year frequency and mixed severity;

**Fire regime IV** – 35 to 100+ year frequency and high severity;

**Fire regime V** – 200+ year frequency and high severity

**Forage** is (1) browse and herbage which is available and can provide food for animals or be harvested for feeding; or (2) to search for or consume forage. ITR 1734-4

**Foraging areas** are the areas that surround the PFAs that goshawks use to hunt for prey. They are approximately 5,400 acres in size.

**Forest land** is land at least 10 % occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential, or administrative areas, improved roads of any width, and adjoining road clearing and powerline clearing of any width.

**Gap** refers to the space occurring in a forested area as a result of individual or group tree mortality from small disturbance events or from local site factors such as soil properties that influence vegetation growth patterns.

**Goals** are concise statements that describe desired conditions to be achieved sometime in the future. They are normally expressed in broad, general terms and are timeless in that they have no specific date by which they are to be completed. Goal statements form the principal basis from which objectives are developed.

**Goods and Services:** The various outputs, including on-site uses, produced from forest and rangeland resources.

**Group** refers to a cluster of two or more trees with interlocking or nearly interlocking crowns at maturity surrounded by an opening. Size of tree groups is typically variable depending on forest community and site conditions and can range from fractions of an acre (a two-tree group) to many acres. Trees within groups are typically non-uniformly spaced, some of which may be tightly clumped.

**Herbage** is the above-ground material of any herbaceous plant. ITR 1734-4 1999

**Invasive species** are species that are not native to the ecosystem being described. For all ecosystems, the desired condition is that invasive species are rarely present, or are present at levels that do not negatively influence ecosystem function.

**Key area:** a relatively small portion of a range selected because of its location, use or grazing

value as a monitoring point for grazing use. It is assumed that key areas, if properly selected, will reflect the overall acceptability of current grazing management over the range.

**Long-term sustained-yield timber capacity (LTSYC)** is the highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity consistent with multiple-use objectives.

**Management concern:** An issue, problem, or a condition which constrains the range of management practices identified by the Forest Service in the planning process.

**Management direction:** A statement of multiple-use and other goals and objectives, the associated management prescriptions, and standards and guidelines for attaining them.

**Management intensity:** A management practice or combination of management practices and associated costs designed to obtain different levels of goods and services.

**Management practice:** A specific activity, measure, course of action, or treatment.

**Management prescription:** Management practices and intensity selected and scheduled for application on a specific area to attain multiple-use and other goals and objectives.

**Multiple use:** The management of all the various renewable surface resources of the NFS so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

**Nest areas (Goshawk)** are the areas immediately around a nest that are used by northern goshawks in relation to courtship and breeding activities. They are approximately 30 acres in size and contain multiple groups of large, old trees with interlocking crowns.

**Objectives** are concise, time-specific statements of measurable planned results that respond to pre-established goals. Objective form the basis for further planning to define the precise steps to be taken and the resources to be used in achieving identified goals.

**Old growth** usually refers to older structural stages and features such as vertical layering, horizontal patiness, and components of live and dead tree decay. In Southwestern forested ecosystems old growth is different than traditional definitions based on Northwestern infrequent fire forests. Old growth is provided for in the desired conditions for Ponderosa Pine, frequent fire Mixed Conifer and Wet Mixed Conifer/Spruce-fir, and in the guidelines for vegetation management activities. For the purpose of this plan, old growth is defined on three scales. At the fine scale, it is an area dominated by large trees with variable density. Some trees exhibit characteristics of decline such as broken tops, and lightning scars, and snags and down logs are often present. At the Mid Scale, it is a multistoried, dominated by large trees over 20 inches in diameter. Canopy cover is 10%-30% when averaged across area 100-1000 acres. At the Landscape scale, old growth occurs as patches of fine and mid scale interspersed across large areas >10,000 acres.

**Openings** are spatial breaks between groups or patches of trees containing grass, forb, shrub, and/or tree seedlings but are largely devoid of big trees.

**Patches** are areas larger than tree groups in which the vegetation composition and structure are

relatively homogeneous. Patches comprise the mid-scale, thus they range in size from 100 to 1,000 acres. Patches and stands are generally synonymous terms, although stands may be much smaller than 100 acres.

**Planning area** is the area of the NFS covered by a regional guide or forest plan.

**Planning horizon:** The overall time period considered in the planning process that spans all activities covered in the analysis or plan and all future conditions and effects of proposed actions which would influence the planning decisions.

**Planning period:** One decade. The time interval within the planning horizon that is used to show incremental changes in yields, costs, effects, and benefits.

**Public issue:** A subject or question of widespread public interest relating to management of the NFS.

**Post-fledging Family Areas** (Goshawk) are the areas that surround the nest areas. They represent an area of concentrated use by the goshawk family until the time the young are no longer dependent on adults for food. PFAs are approximately 420 acres in size.

**Range Condition** is a subjective expression of the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community. (USDA Forest Service, Southwestern Region, Record of Decision for Amendment of Forest Plans, Arizona and New Mexico.) It is evaluated relative to Desired Conditions.

**Range Readiness** is the condition when grazing would not permanently damage perennial plants which is determined when plants that would likely be grazed exhibit at least when at least one of the following characteristics: seed heads or flowers, multiple leaves or branches, and/or a root system that does not allow them to be easily pulled from the ground. These characteristics provide evidence of plant vigor, reproductive ability, and recovery.

**Recreation Opportunity Spectrum** [Insert definition, including the specific settings.]

**Resilience** is an ecosystem concept used to infer the capacity of the system to absorb disturbance and reorganize so it retains essentially the same function, structure, and identity.

**Responsible line officer** is the Forest Service employee who has the authority to select and/or carry out a specific planning action.

**Satisfactory Range Condition** is the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community as evaluated relative to Desired Conditions; deemed meeting or moving towards those Desired Conditions. (Adapted from USDA Forest Service, Southwestern Region, Record of Decision for Amendment of Forest Plans, Arizona and New Mexico.)

**Satisfactory Watershed Condition** is a state where ground cover conditions are effectively maintaining land productivity.

**Scenic Integrity Objectives** in the context of the plan are equivalent to 'goals' or desired conditions'

**Silvicultural system** is a management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the fellings that remove the mature crop and provide for regeneration and according to the type of forest thereby produced.

**Snags** are standing dead or partially dead trees (snag-topped), often missing many or all limbs. They provide essential wildlife habitat for many species and are important for forest ecosystem function.

### **Soil Condition Rating**

**Suitability** is the appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices.

**Timber production** is the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of this subpart, the term timber production does not include production of fuelwood.

**Uneven-aged** forests are forests that are comprised of three or more distinct age classes of trees, either intimately mixed or in small groups.

**Uneven-aged management** is the application of a combination of actions needed to simultaneously maintain continuous high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

**Unsatisfactory Range Condition** is the status or health of the vegetation and soil relative to their combined potential to produce a sound and stable biotic community as evaluated relative to Desired Conditions deemed not meeting or moving towards those Desired Conditions. (Adapted from USDA Forest Service, Southwestern Region, Record of Decision for Amendment of Forest Plans, Arizona and New Mexico.)

**Unsatisfactory Watershed Condition** is a state where effective ground cover conditions are such that impairment of land productivity is occurring.

**Wetlands** are those areas that are inundated by surface or ground water with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil condition for growth and reproduction. Generally includes swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds.

**Wildland Urban Interface (WUI)** are those areas of resident populations at imminent risk from wildfire, and human developments having special significance. These areas may include critical communications sites, municipal watersheds, high voltage transmission lines, observatories, church camps, scout camps, research facilities, and other structures that if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved.

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## **Appendix 1. Kaibab National Forest Approach for Addressing Climate Change for Plan Revision**

This appendix summarizes guidance excerpted from *Southwestern Climate Change Trends and Forest Planning A Guide for Addressing Climate Change in Forest Plan Revisions for Southwestern National Forests and National Grasslands* (USDA Forest Service-Southwestern Region, May 2010) for the Kaibab Forest Plan.

### ***Introduction***

Climate scientists agree that the earth is undergoing a warming trend, and that human-caused elevations in atmospheric concentrations of carbon dioxide and other greenhouse gases are among the causes of global temperature increases. The observed concentrations of these greenhouse gases are projected to increase. Climate change may intensify the risk of ecosystem change for terrestrial and aquatic systems, affecting ecosystem structure, function, and productivity.

Strategies for protecting climate-sensitive ecosystems through management will be increasingly important because changes in the climate system will likely continue regardless of emissions mitigation. Climate change exacerbates the already difficult task of managing the NFS for multiple goals. This document summarizes how the Kaibab intends to incorporate current and possible future climate change into our land management planning process. The primary consideration for evaluating responses to climate change is how likely it is to modify social, economic, and ecological conditions on the planning unit.

### ***Current Conditions and Trends***

Current conditions and trends described in the Draft Environmental Impact Statement (DEIS) for the Proposed Kaibab Forest plan and alternatives will discuss risks, vulnerabilities, and potential ecological changes that could result from climate change. The plan addresses potential climate change impacts that are most likely to affect ecological systems, goods, and services. Evaluation of climate change impacts may lead to recognition that some conditions may be difficult to maintain over time. Particular attention will be given to ecosystems that are most at risk due to climate change and vulnerable ecosystem components, such as aquatic systems, grassland plant diversity, and alpine ecosystems. Information from the evaluation of current conditions and trends was used to develop social, economic, and ecological goals and desired conditions that provide system resiliency.

### ***Integrating Climate Change into Land Management Plans***

Climate change is addressed as an integrated part of the Kaibab NF land management plan, rather than as a stand-alone set of desired conditions. For example, “The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances and components that provide resiliency to climate variability.”

Goals and desired conditions for the planning unit were developed that considered potential climate effects to:

- Increased extreme weather related forest disturbances (floods, drought, wind-throw)
- Water stresses (ground water, run-off, and timing), aquatic biota

- Wildfire risks
- Shifts in major vegetation types for the Southwest
- Threatened, and endangered, and sensitive species
- Forest insects and disease
- Weather-related stresses on human communities (temperature, air quality)
- Outdoor recreation

### ***Monitoring***

No specific program is being developed solely for monitoring climate change. However, the forest plan monitoring program will incorporate provisions that should improve understanding of the relationships between key plan components and climate change. For example, inventory of aquatic ecosystems would collect information about water temperatures and water flows associated with climate change and be useful for tracking variability within ecosystem condition and trends observed over a prescribed evaluation period.

### ***Decision Documents***

Pertinent aspects of climate change will be addressed in the rationale section of the decision documents, particularly those that may affect the social, economic, and ecological systems within the planning unit that are most at risk. Examples of ecosystems, characteristics, and species most at risk include fire adapted vegetation, native aquatic species, and endemic species. Examples of socioeconomic systems at risk of change include wildland-urban-interface values at risk from uncharacteristic fires, ranching operations, winter recreation, and personal use products industries. Decision documents will clearly articulate how climate change was considered in the land management planning process, specifically relative to the current conditions and trends, development of goals, desired conditions, and in the monitoring sections of the plan record.

### ***Potential Climate Change Effects***

Based on current projections, the primary regional-level effects of climate change most likely to occur in the Southwest include: (1) warmer temperatures, (2) decreasing precipitation, (3) decreased water availability with increased demand (4) increased extreme disturbance events, and (5) increased use of National Forests for relief from higher temperatures for lower elevation cities. These climate change factors could in turn affect ecological, weather-related disturbances, and socioeconomic demands, including increases in:

- the frequency of extreme weather events (intense storms),
- wildfire risks,
- outbreaks of insects, diseases, and spread of non-native invasive species.
- demand for water, and
- National Forest socioeconomic uses and demands.

### ***Extreme Weather Events***

Climate change likely will increase flashfloods, making the region's growing population more susceptible to loss of life and property. While the Southwest is expected to become warmer and drier, it is likely to experience more flooding. This relates in part to the fact that warm air holds more moisture than cooler air. The frequency of floods is also influenced by the rate of snowmelt



in the winter and spring, the character of the summer monsoon, and the incidence of tropical hurricanes and storms in the autumn.

Hurricanes and other tropical cyclones are projected to become more intense in the future. Since Arizona typically receives 10 percent or more of its annual precipitation from tropical storms, it is likely that this change will also increase flooding. A potential increase in extreme storms, floods, heat waves, and droughts may present challenges for achieving desired conditions.

Impacts from extreme weather events could include changes in the composition and diversity of desired ecosystems; destruction of habitat; timber loss; increasing damage to infrastructure such as trails, facilities, and roads; and loss of recreation opportunities. Disturbances that exceed the historic range of natural variation can change the makeup, structure, and function of watersheds and some vegetation types, could affect a number of desired conditions. Heavy rains and higher flood levels can affect maintenance and structural integrity of built infrastructure and slow progress toward improvements. Flooding is a natural and beneficial disturbance in many aquatic systems. However, damage to aquatic systems from flashflood-caused erosion, downed trees, and inundation from flooding can change streamside habitats, affect aquatic life, and impact proper functioning of stream channels. These disturbances could create challenges in the ability of a Forest to achieving Plan objectives for aquatic habitat restoration. Overall, increasing weather-related disturbances can divert limited Forest staff and funding to recovery efforts for extended periods and delay progress toward desired conditions, or require reconsideration of desired conditions, to allow for a more dynamic resilience.

### ***Wildfire***

Historically, wildfires have played an important role in the vitality of fire-adapted ecosystems. Past forest management and fire suppression practices have changed the dynamics of fire on the landscape within the Southwestern Region's National Forests, resulting in greater fuel-loads and risk of wildfire. A combination of fire suppression and Federal land-management agencies in the West routinely exceed expenditures of over \$1 billion per year for wildfire suppression. Since about the mid-1970s, the total acreage of area burned and the severity of wildfires in pine and mixed-conifer forest have increased.

Fire frequency and severity will likely increase as temperatures rise and precipitation decreases. Severe wildfires reduce the land's ability to sequester and store carbon. Population growth in the Southwest may also lead to greater numbers of human-caused wildfires. The 2002 Rodeo-Chediski fires in Arizona were both started by humans and combined to burn nearly half a million acres, the largest fire on record in Arizona (Joyce et al. 2008).

### ***Outbreaks of Insects, Diseases, and Non-Native Invasive Species***

Disturbances associated with climate change can have secondary impacts indirectly caused by wildfire and climate-related extremes. Increased variation in temperature and moisture can cause stress and increase the susceptibility of forest ecosystems to invasions by insects, diseases, and non-native species. New environmental conditions can lead to a different mix of species and tend to be favorable to plants and animals that can adapt their biological functions or are aggressive in colonizing new territories (Whitlock 2008). However, changes in adaptability may be too slow given the predicted rate of change. Species that are already broadly adapted may become more prevalent and species with narrow adaptability may become less prevalent. Disturbance factors

that create more vulnerability in native ecosystems or require extensive controls to maintain the status quo are likely to affect desired conditions for healthy and diverse forests.

Desired conditions for healthy forests include resilience to dramatic changes caused by abiotic and biotic stressors and mortality agents (pine beetle), and a balanced supply of essential resources (light, moisture, nutrients, growing space). Insects and diseases typically invade in cycles followed by periods of relative inactivity. Non-native invasive species, such as cheatgrass and saltcedar, are expected to continue to increase in numbers and extent. Vulnerabilities to forest threats from an environment that may be much different from the historic range of natural variability is an active area of research, and includes developing new management approaches for changing conditions.

### ***Diminishing Water Resources***

The locations of most snow-pack and upland reservoirs are on National Forests in the Southwest. In much of the Southwest, less precipitation is falling as snow, and spring melting is occurring earlier in the year. The Colorado River, Rio Grande, and several other southwestern rivers have streamflows that appear to be peaking earlier in the year, suggesting that the spring temperatures in these regions are warmer than in the past, causing snow to melt earlier. Water supplies are projected to become increasingly scarce, calling for trade-offs among competing uses, potentially leading to conflict. In the Southwest, intense debate will likely continue over resource allocation and conservation of available supplies.

### ***Climate-Related Socioeconomic Demand***

Populations in Arizona and New Mexico are growing at an unprecedented rate. As of the latest American Communities Survey 2006, Arizona's population was over 6 million. The total increase for Arizona between 1980 and 2006 was 123 percent. The combination of population growth and climate change will likely exacerbate climatic effects, putting even greater pressure on water, forest, and other resources. Climate change could have long-term impacts on many of the amenities, goods, and services from forests, including productivity of locally harvested plants such as berries or ferns; local economics through land use shifts from forest to other uses; forest real estate values; and tree cover and composition in urban areas and associated benefits and costs.

### ***Management Strategies to Address Key Climate Change Concerns***

To address the key climate change factors of most concern, land management plans should:

1. Reduce vulnerability by maintaining and restoring resilient native ecosystems,
2. Increase water conservation and plan for reductions in upland water supplies,
3. Anticipate increase in forest recreation use, utilize markets and demand for wood and biomass for restoration, renewable energy, and carbon sequestration,
4. Enhance adaptation by anticipating and planning for disturbances from intense storms,
5. Monitor climate change influences.

Managing ecosystems under uncertainty necessitates flexible and adaptive approaches that are reversible, are implemented in incremental steps, and which allow for new information and learning, and that can be modified with changing circumstances (Millar et al. 2007).

Southwestern ecosystems have evolved under a long and complex history of climate variability and change. Taking into consideration the number of mega-droughts, and other climate-related variation, through time, these southwestern systems have a built-in resilience. Restoring and maintaining resilience in forest and grassland ecosystems should be part of the basic elements of Forest-wide desired conditions. Risks of increased wildfire, outbreaks of insects and disease, and invasive species, represent ongoing, broad-scale management challenges. These issues are nothing new. However, climate change has the potential to increase or augment the impacts of these ecosystem risks.

Restoring and maintaining resilience will likely improve the potential for ecosystems to retain or return to desired conditions after being influenced by climate change related impacts and variability. Managing for resistance (e.g., maintenance thinning to prevent catastrophic fire, forest insect or disease pandemics) and resilience (e.g., noxious weed control) offer meaningful responses to climate change.

Prescribed fires are a management tool that can serve multiple purposes, from sustaining desired conditions for fire-adapted ecosystems and sustaining habitat for threatened and endangered species, to reducing fuel loads. Prescribed burning is also a management strategy that will be important for maintaining desired habitats in a changing climate with more natural disturbances. With projections of storms that are more frequent, and other more extreme weather events, plus the potential for increased stresses from forest pests in a warmer, drier climate, continued prescribed burning will continue to be an important management strategy for the future.

Although current programs and guidance are already in place to limit introduction of non-native species, treat invasive species, and control insects and diseases, these efforts are likely to become more critical to maintaining desired conditions for healthy forests under a changing climate. Due to the fragmented land ownership patterns, success in reducing forest pests requires going beyond National Forest boundaries, and continued collaboration with partners will be needed. In addition, management practices (such as thinning for age-class diversity) that sustain healthy forests and provide adequate nutrients, soil productivity, and hydrologic function promote resilience and reduce opportunities for disturbance and damage.

Managing for landscape connectivity will be important as connectivity facilitates movement of species among habitats (Taylor et al., 1993, Millar et al. 2007). Connectivity has two components, structural and biological connectivity and biological components. Structural connectivity, the spatial structure of a landscape, can be described from map elements. Biological connectivity is the response of individuals to the scale of landscape features (Brooks 2003). Promoting connectivity in landscapes with flexible management goals that can be modified as conditions change may assist species to respond naturally to changing climates. Desired goals include reducing fragmentation and planning at large landscape scales to maximize habitat connectivity (Millar et al. 2007).

By managing for resistant and resilient ecosystems, promoting landscape connectivity, and implementing concepts of adaptive management, land management plans can provide the framework for responding to new information and changing conditions related to climate change that have the potential to increase impacts to ecosystem risks. The revised Kaibab land

management plan should provide clear management direction and include the necessary monitoring and mechanisms that will facilitate adaptation over time.

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